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UNDERSTAND IT
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SEE PAGE 76

Now! Clean, sparkling water at the faucet!

Be sure it's FILTERED!

Think of it! A new, amazing, invention that now helps protect your health by removing dirt, filth, scum and impurities from the water—at the faucet! Just a turn of the faucet, and the water comes thru filtered and as sparkling as though coming from one of nature's crystal springs.

Millions of homes absolutely need it. Millions of careful mothers have been waiting ever so long for this remarkable device!

Now, with one sweep, gone are the days of drinking dirt. That's why faucets by the ...most overnight — are ...n the Famous Automatic Water ... stand guard over the health!

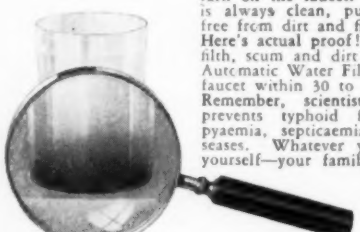
Guards Family's Health

Nothing mysterious. Remarkably simple because it uses Nature's own method of filtering through crystal sand. So convincingly removes dirt, filth and scum you can see it with the naked **eye.**

There's danger in impure water—danger of illness, disease, even death. Once you see for yourself—realize how much dirt and filth is brought into your home in raw, unfiltered water, you'll wonder why a necessity like **the "Automatic" has never been perfected before.** You'll promise yourself never, never again to be without it—never to let your family's health unguarded.

Filters Water . . . *Instantly* . . .

Slips onto the faucet in a moment. Once there, it stays. It'll never come off again, because it means so much to health and happiness.



Filters instantly—the very second you turn on the faucet. And, the water is always clean, pure, spring-like—free from dirt and filth.

Here's actual proof! Pictured is the filth, scum and dirt collected by the Automatic Water Filter at an average faucet within 30 to 45 minutes' use. Remember, scientists say filtration prevents typhoid fever, erysipelas, pyaemia, septicaemia and other diseases. Whatever you do!—protect yourself—your family. Arrange now to put this health protector on your faucet. Act today!

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GUARANTEE

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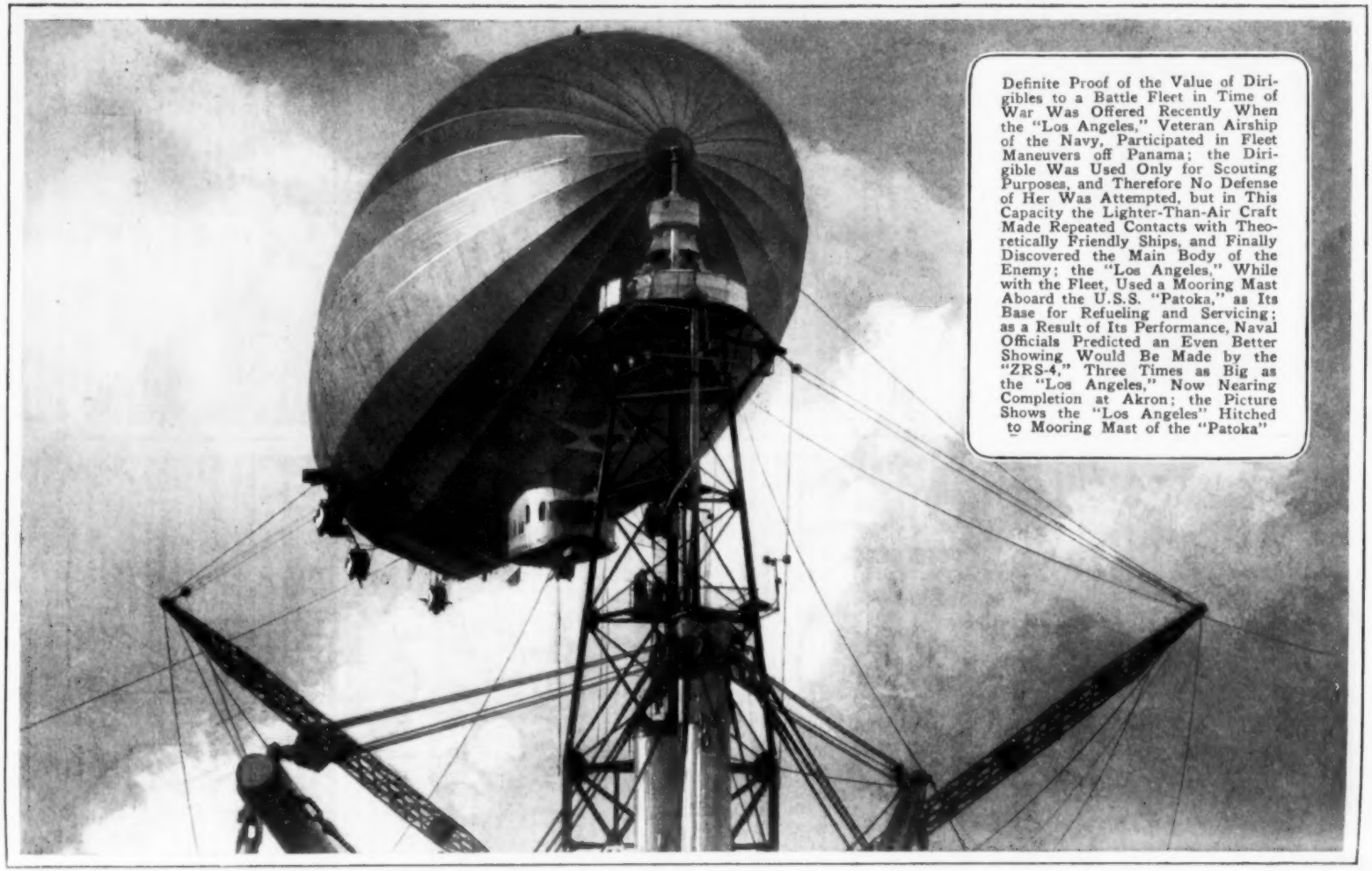

Definite Proof of the Value of Dirigibles to a Battle Fleet in Time of War Was Offered Recently When the "Los Angeles," Veteran Airship of the Navy, Participated in Fleet Maneuvers off Panama; the Dirigible Was Used Only for Scouting Purposes, and Therefore No Defense of Her Was Attempted, but in This Capacity the Lighter-Than-Air Craft Made Repeated Contacts with Theoretically Friendly Ships, and Finally Discovered the Main Body of the Enemy; the "Los Angeles," While with the Fleet, Used a Mooring Mast Aboard the U.S.S. "Patoka," as Its Base for Refueling and Servicing; as a Result of Its Performance, Naval Officials Predicted an Even Better Showing Would Be Made by the "ZRS-4," Three Times as Big as the "Los Angeles," Now Nearing Completion at Akron; the Picture Shows the "Los Angeles" Hitched to Mooring Mast of the "Patoka"

Popular Mechanics Magazine
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Vol. 55 MAY, 1931 No. 5

The Smallest Living Things

By JOHN F. COGGSWELL

THE SMALLEST living organisms known to man are to become one of his greatest allies in the constant battle against germ diseases. In his laboratory at Yale University, Dr. F. d'Herelle has discovered these and made them do his bidding.

There is an old saying that even the smallest bugs have smaller bugs that live upon them. That seems to be the literal truth. Certainly, we have long believed that the smallest bugs in the world are bacteria—call them germs or microbes, if you wish—those minute organisms that cause milk to sour, meat to spoil and also, among many other activities, are believed to implant within our systems those ailments known as germ diseases.

Test Tube Containing 40,000,000,000 Bacteriophages, Smallest Living Organisms Known, and Typhoid Bacteria in Gelatin Being Devoured by Them

Bacteria are small, no doubt about that. A hundred of them can play tag on the head of a pin. They can be seen only under the lens of the most powerful microscope. Millions of

Vacuum Filter Used to Separate Bacteriophages from Bacteria; Right, Bacteria Being Destroyed

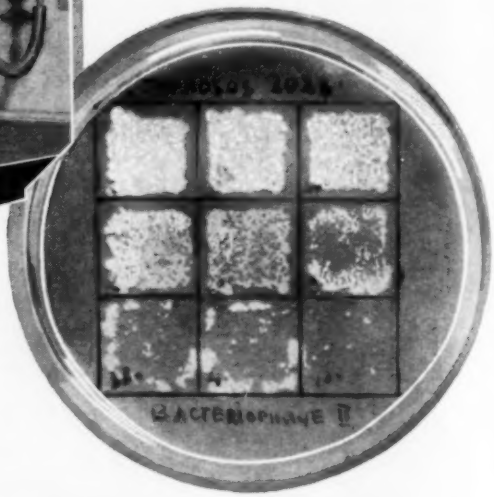
them can find lodgment on one small spot in the human throat. They are small, but the organisms discovered by Doctor d'Herelle are a thousand times smaller. They are the parasites that infest and cause disease in bacteria, just as bacteria infest and cause disease in the human system.

Medical experts look upon the development of Doctor d'Herelle's discovery, which was given enthusiastic acclaim at the recent convention of the American Society of Bacteriologists, as a most important step toward the banishment of germ diseases. Already he has proved, under the most difficult conditions, the ability of the tiny organisms to defeat one of the most virulent epidemic diseases that the world has ever known—Asiatic cholera.

These parasites that infest bacteria are known as bacteriophages—which, literally, means bacterium eaters. They are so small that forty billion of them in half a test tube of liquid do not even cloud the solution. They are infinitesimal but they work fast. One of Doctor d'Herelle's favorite demonstrations is to dip just an inch or two of a fine wire into a solution containing bacteriophages—the name is shortened to "phage" in laboratory parlance.

Then, the same wire, with its load of phages, is dipped into a test tube holding a solution made turbid by several million typhoid-fever bacteria. Within three hours—so fast do the phages multiply when furnished with their favorite food—the solution becomes clear and the most rigid tests fail to discover a single typhoid bacterium left alive.

Of course, no one has ever seen a bacteriophage and no one will until a microscope many hundred



times as strong as any in existence is invented. Their discovery was the result of pure reasoning. Doctor d'Herelle, in common with all physicians and most laymen, knew that germ diseases are not always fatal, as they would be if the bacteria kept on multiplying indefinitely.

Such diseases progress to a certain point; then the patient either dies or begins to show improvement. Physicians long believed that the patient's body developed power to resist the onslaughts of the disease bacteria, which were then thrown off. The Yale doctor, however, came to the conclusion that some enemy organism must attack the bacteria and render them incapable of causing harm.

Doctor d'Herelle's method of finding the cause of destruction of the bacteria is illustrated by his procedure in the isolation of the cholera bacteriophage. He selected a case of cholera in which the disease had

run its course and the patient was on his road to recovery. The doctor made an emulsion of the patient's excretions and passed this emulsion through a filter, too fine to allow passage of the smallest cholera germ. A few drops of the solution that did pass through the filter, when placed in another solution containing millions of healthy cholera bacteria, immediately spread destruction.

A first spectacular demonstration of the efficiency of the bacteriophage was recently brought to successful development. Doctor d'Herelle was asked by the British government to lend his aid in stamping out cholera in India. He journeyed to that country and centered his activities at Puri. Cholera was rampant there and in the surrounding district. The wells became contaminated and the disease spread. Doctor d'Herelle and his assistants prepared solutions of cholera bacteriophages. Throughout the city and district they dumped small quantities into wells. In a short time the death rate decreased and the number of cases fell off.

NEW BATTLE WAGON HAS LONG CRUISING RADIUS

Uncle Sam's latest battle wagon is a lightweight armored car for the use of the army. It is operated by three men, has a road speed of sixty miles an hour and a cruising radius of 200 miles on one filling of gasoline. It has a turret like a heavy army tank in which are mounted two machine guns.

Light Armored Car Tested for the Army; It Can Travel Sixty Miles an Hour and Has a Cruising Radius of Some 200 Miles

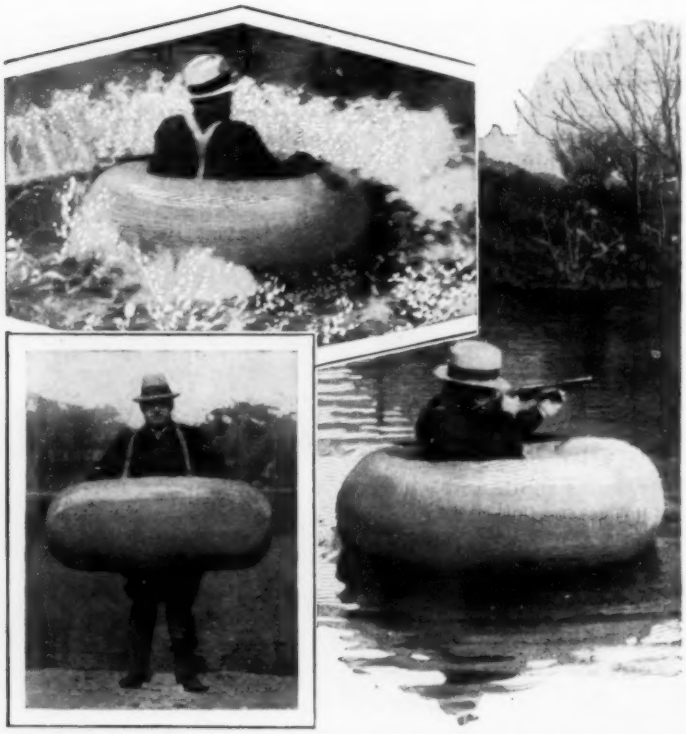
PICTURE MADE WITH BULLETS BY A PISTOL EXPERT

Indian Head "Painted" with Bullets by Detroit Policeman at Distance of Forty-Five Feet

With a tinplate for a canvas and his pistol for a brush, an expert marksman of the Detroit police department recently "painted" an Indian head at a distance of forty-five feet. He used a thirty-eight-caliber pistol to outline the features and feathers with 125 bullets.

ELK AND DEER LEAP PARK FENCE BUT RETURN

Deer and elk in Platt national park, Oklahoma, refuse to stay in their paddocks and also to stay out. Deer, elk and buffalo are kept in fenced-in pastures, but recently all the white-tail deer leaped the fence and fled. After several days they returned of their own accord and entered the inclosure in the same way they left.



Inflated Rubber Boat Which Resembles a Huge Doughnut and Is "Worn" by Duck Hunters and Fishermen; It Is Easily Carried When Deflated

RUBBER BOAT LIKE A DOUGHNUT HELPS FISHERMEN

Resembling a huge rubber doughnut, an inflated boat has been made for duck hunters and anglers that is worn about the waist. This light "walking" boat is inflated and placed about the waist when entering the water, and does not interfere with walking on land. When deflated it occupies but small space and is easily carried by the hunter. For greater safety, there are two bags, one inside the other, both of which are inflated. The outer boots are vulcanized to the tube, as are rings for attaching suspenders. When the angler gets beyond wading depth, he can propel the craft with a double paddle or attach collapsible propellers to the back of each leg. These collapse when the leg moves forward, but open up at the backward motion, advancing the wearer.

¶Alternating current sufficient to supply the average home can be generated by an electric power plant, run by a gas engine, which has been marketed recently.

COAL BETTER THAN SAND AS FILTER FOR WATER

Scientists have found recently that anthracite coal is an effective filter for water, being much better than sand and gravel. Tests have shown that certain grades of anthracite, properly prepared, filter out as much as ninety-nine per cent of bacteria in polluted waters, and in addition remove colors and odors.

INSECT PESTS ARE IDENTIFIED BY BIG PICTURES

Farmers are being aided in identifying various kinds of insect pests by pictures of these bugs in giant size, which are painted by artists at the direction of the department of agriculture. Enlarged to such a size that they look like prehistoric monsters, the insects are easily recognized by the farmer after he has had a close-up of the magnified bugs. The pictures thus will serve as a sort of bureau of identification in waging war on these insect criminals.

Painting Large Pictures of Insect Pests to Enable Farmers to Recognize Them More Easily

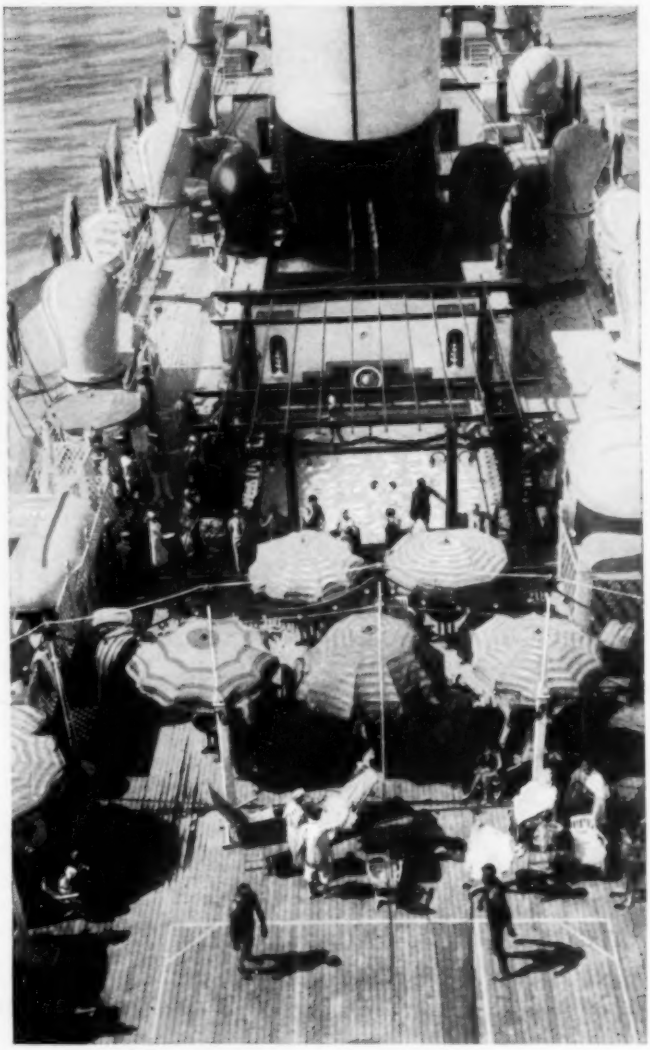
NEW USES FOUND FOR CACTUS PLANTS

Cactus plants, heretofore considered a useless nuisance, recently have been found the basis for a new and rapidly growing industry. From them now are produced various drugs, soap, cleaners, water softeners and a boiler compound, which is the latest commercial product of the desert plant and has proved a boon to mechanics and engineers. One gallon of cactus juice placed in 10,000 gallons of water will purify an entire heating system and prevent it from being clogged by scale and corrosion. It can be used also for cleaning rust from exposed casings and removing harmful minerals in steam used in the manufacture of food preparations.

LOUD SPEAKERS ON SHIP SHOUT ORDERS

Forty loud speakers compose a robot boatswain's mate on a large battleship recently constructed in England. The telephone-radio equipment, located at strategic points over the vessel, shouts the commander's orders in stentorian tones heard by every member of the crew. At other times the system broadcasts music from the ship's orchestra. As a test before the apparatus was accepted, men with heavy sledge hammers beat on the iron plates to which the speakers were fixed, the amplifiers being required to operate in spite of this abuse.

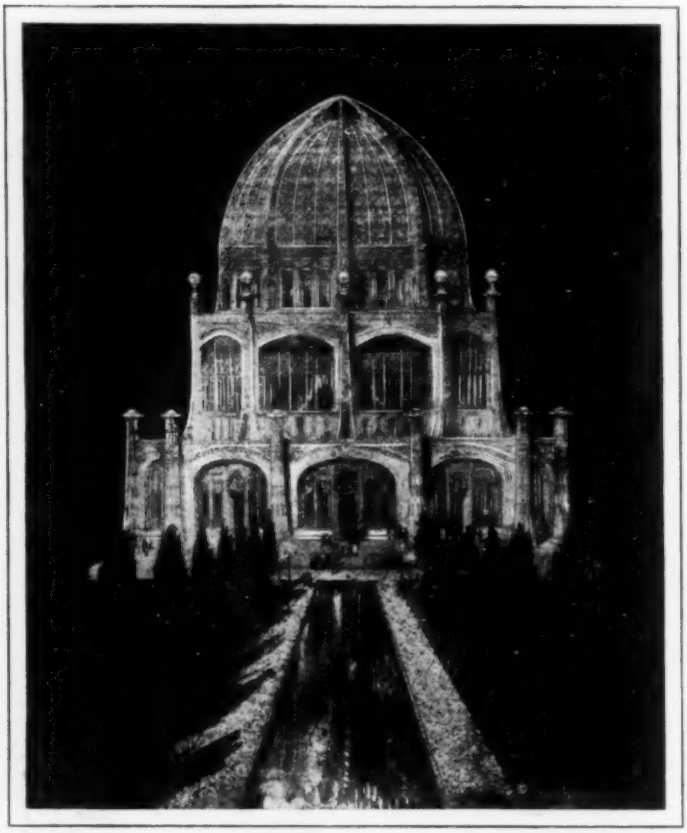
¶A free-wheeling clutch unit for Ford cars now is available.



Scene on the Deck of an Italian Liner Which Has Been Transformed into a Seaside Beach, Lacking Only the Sand to Make It Realistic

LINER'S DECK MADE INTO BEACH LACKING ONLY SAND

In good weather, the deck of the Italian steamer "Roma" is transformed into an ocean beach for the enjoyment of the passengers during a voyage. All the paraphernalia of a typical seaside resort, including beach tents and facilities for playing various games, are provided. About the only thing the absence of which mars the complete illusion of an actual beach, is sand.



© Louis Bourgeois

Architect's Drawing of Bahai Temple, Nearing Completion; Many Believe It Will Be One of World's Most Beautiful Structures

TRIUMPH OF ARCHITECT'S ART SEEN IN MODERN TEMPLE

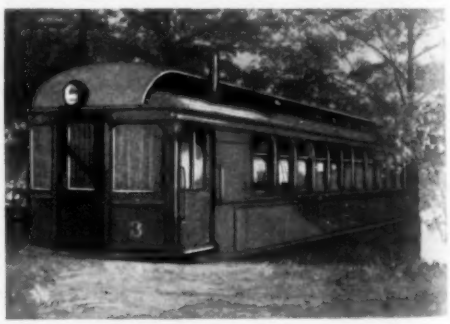
Bahai temple, considered by many to be one of the most beautiful specimens of architecture in the world, is nearing completion at Wilmette, Ill., near Chicago. A fire in the dome of the partly finished building, which will be the home of a religious movement, recently caused $50,000 damage to the $1,500,000 structure. Louis Bourgeois, the architect, died while the temple was being built.

FISH SHOOTS DROP OF WATER AT INSECTS

Little fish that shoot the insects on which they feed with liquid projectiles have been under observation in Bangkok by Dr. Hugh M. Smith, former United States fish commissioner. The fish uses a drop of water for a bullet and is so accurate that on two different occasions it extinguished lighted cigarets in the mouths of smokers two yards above the water. When the fish sights a likely candidate for dinner, it pokes its eyes and the tip of its snout above water, holding its body at an angle. It opens its wide mouth a trifle, and at the same instant squeezes its gill covers to propel the "bullet" which has such force that it has been known to dislodge a small lizard. The spitting fish has an effective range of from one to two yards, but can project a drop of water twice or thrice as far.

RAIL CAR IS MADE INTO SUMMER COTTAGE

Beside a Michigan lake stands an interurban car which has been converted into a summer cottage with many conveniences. It was moved to the lake on a truck and trailer. The motorman's compartment is now a kitchen, which also contains a hot-water heating plant; the smoker has been made into a dining room, and the passengers' compartment has been converted into a living room.



Old Interurban Car Taken to a Lake and Transformed into a Comfortable Summer Cottage

FIRECRACKERS PLAY BIG PART IN CHINESE CUSTOMS

Firecrackers in China are used not only on holidays, but play an important part in weddings funerals, anniversaries and similar occasions. At the wedding of a wealthy Chinese couple often from 50,000 to 150,000 of them are fired. These are strung on long ropes, sometimes reaching from the roof of a seven-story building to the street below, and a rope requires from twenty to thirty minutes to go off. China makes its own firecrackers and also exports them throughout the world, old American newspapers often being used to wrap them.

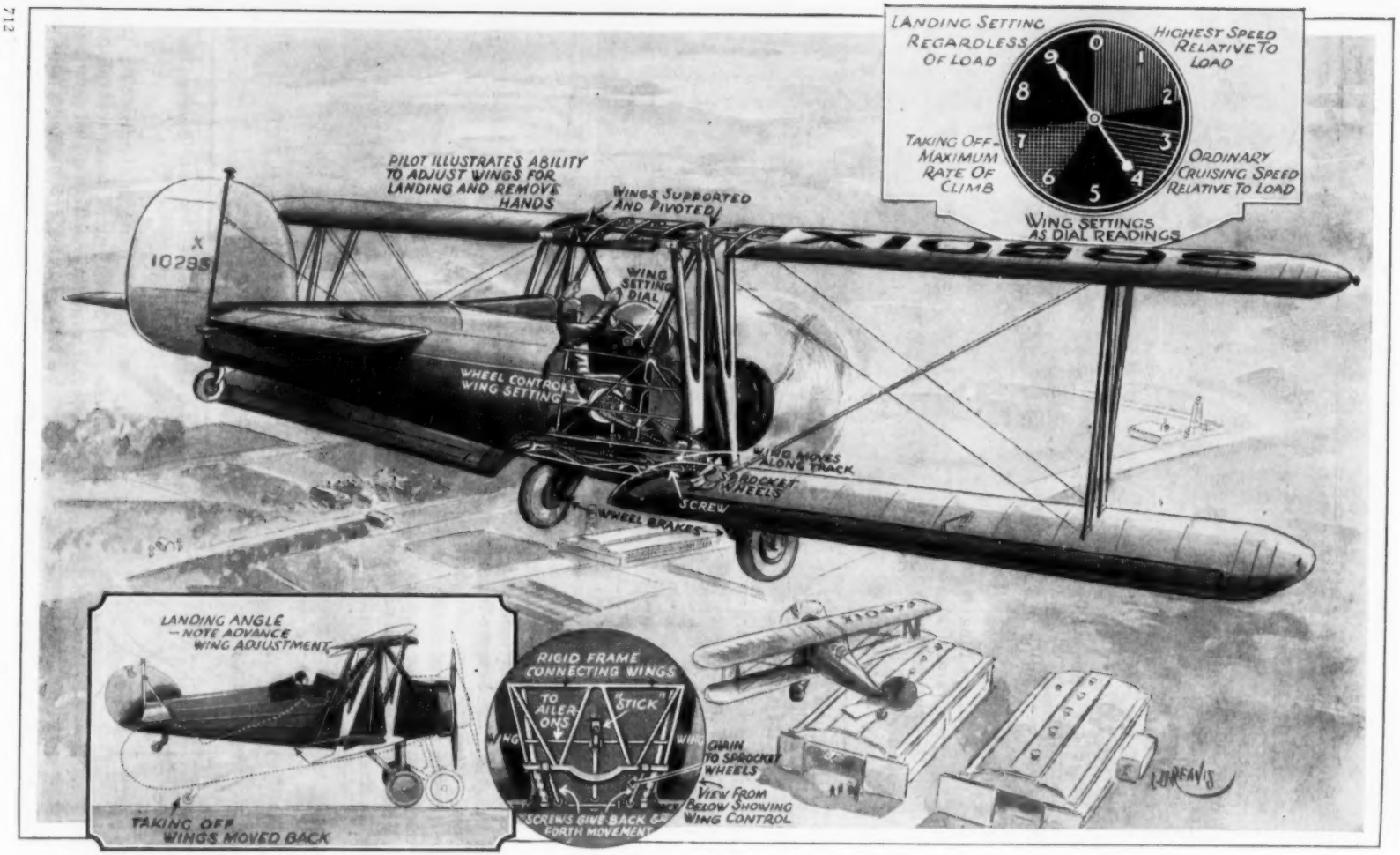
WETTING WITH STEAM ELIMINATES DUST FROM COAL

Steam, instead of water, now is being used as a more effective method of wetting down coal to lay the dust before making deliveries. Previously, a hose was turned on the coal after it was weighed, the top being soaked. Now a steam pipe with a nozzle is forced to the bottom of the load at three or four points, and the entire load is saturated in a few minutes, the dust being eliminated without any excess of water. The steam is conveyed to the pipe through a rubber hose, and leaves the boiler at a pressure of from seventy-five to ninety pounds.

BIG BATTLESHIP FILLS CANAL ON VISIT TO PANAMA

When the British battleship "Nelson," one of the largest and most modern fighting craft in the world, recently paid an official visit to the United States fleet at Panama, it was found that the Panama canal was a tight squeeze for the huge flagship of the British Atlantic fleet. At one point, the boat scraped the lock walls but no damage was done. This British fighter carries nine sixteen-inch guns, twelve six-inch guns and several anti-aircraft guns, as well as a full equipment of the latest in modern paraphernalia for naval warfare.

Views of the Giant British Battleshio "Nelson," Squeezing through Locks of Panama Canal


LANDING SETTING REGARDLESS OF LOAD
HIGHEST SPEED RELATIVE TO LOAD
TAKING OFF - MAXIMUM RATE OF CLIMB
ORDINARY CRUISING SPEED RELATIVE TO LOAD
WING SETTINGS AS DIAL READINGS
PILOT ILLUSTRATES ABILITY TO ADJUST WINGS FOR LANDING AND REMOVE HANDS
WINGS SUPPORTED AND PIVOTED
WING SETTING DIAL
WHEEL CONTROLS WING SETTING
WING MOVES ALONG TRACK
SPROCKET WHEELS
SCREW
WHEEL BRAKES
LANDING ANGLE — NOTE ADVANCE WING ADJUSTMENT
TAKING OFF WINGS MOVED BACK
RIGID FRAME CONNECTING WINGS
TO AILERONS
"STICK"
CHAIN TO SPROCKET WHEELS
VIEW FROM BELOW SHOWING WING CONTROL
SCREWS GIVE BACK & FORTH MOVEMENT

Safety Plane with Tilting Wings Which Can Land Itself, and Mechanical Features Making the Feat Possible; the Wing Structure Is Pivoted to the Braces Connecting It to the Fuselage, and the Tilt of the Wings Is Controlled by a Wheel in the Cockpit

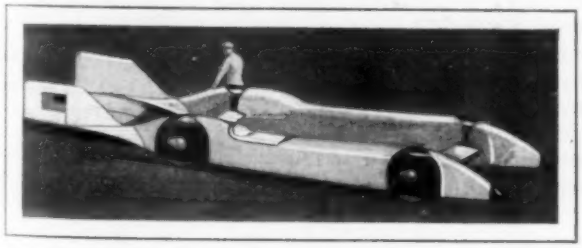
SAFETY PLANE LANDS ITSELF WITH TILTING WINGS

Prof. Albert Adams Merrill has announced the development of an airplane which may be as easy for the average man to learn to fly safely as it is to run an automobile safely. The following extraordinary claims are made for this plane: It can be landed safely with the pilot's hands removed from the controls. It cannot be put into a dive, stalled, and it will not go into a spin. It cannot be made to do acrobatics of any description. In a recent demonstration, a representative of Popular Mechanics Magazine saw the plane land repeatedly with the pilot's hands high above his head. Although, at first glance, the plane appears of conventional design, a closer inspection reveals two unusual features: First, the complete biplane wing structure is pivoted to the braces which connect this structure to the fuselage; second, there are no stabilizers. By operating a wheel within the pilot's cockpit, the tilt of the wings may be changed from a small angle for straight-away flying up to an angle of fourteen degrees for take-off or landing. With the wings at fourteen degrees, the pilot can throttle the engine to idling, and remove his hands from the controls while the plane automatically assumes the correct gliding angle and maintains it until it reaches the ground.

Safety Plane with Tilting Wings Which Can Land Itself, and Mechanical Features Making the Feat Possible; the Wing Structure Is Pivoted to the Braces Connecting It to the Fuselage, and the Tilt of the Wings Is Controlled by a Wheel in the Cockpit

U. S. CAR AFTER SPEED RECORD HAS MOTOR IN EACH WHEEL

In an attempt to break the automobile-speed record of more than 245 miles an hour established a few months ago, an American car of revolutionary design is being constructed by E. J. Pennypacker, of Hollywood, Calif. It will be driven by four motors, one in each wheel.



American Car That Will Try for World Speed Record

Girl Being Weighed on Huge Scales That Can Lift and Weigh 10,000-Pound Metal Ingots

SCALES THAT LIFT FIVE TONS ALSO WEIGHS PERSON

Huge scales that lift, swing and weigh metal ingots up to 10,000 pounds recently were exhibited and demonstrated at a metal congress on the Pacific coast. Despite their giant size and capacity, the scales were found delicate enough to record the correct weight of a 135-pound girl.

DO GOPHERS PREY ON SNAKES?

Many farmers of Alberta, Canada, have decided that gophers are responsible for ridding some sections of rattlesnakes. It was observed that the snakes became less numerous as soon as gophers invaded rattlesnake territory, and are not found on wheat farms where the gophers abound. It is thought they feed on the snakes while these are dormant.

THOUSANDS OF LADYBUGS A DAY GROWN ON FARM

Raising bugs to eat other bugs is the sole purpose of an insect farm in California with a capacity of from 80,000 to 300,000 ladybugs a day. When mealy bugs threatened to destroy orange groves valued at $5,000 an acre, citrus growers began searching for a means of controlling this pest and found the answer in the Australian ladybug, which is a deadly enemy of the other insect. A few thousand were imported, and a small building was constructed as a nursery for them. Today the farm includes twenty-eight buildings, each of six rooms or bug compartments. The feed bill includes over 5,000 sacks of the finest potatoes a year, and a crew of men is employed to tend the baby insects. The temperature in the bug room is kept near eighty degrees constantly and the larvæ are grown on the sprouts of potatoes. The grown bugs are easy to catch, as their quarters are kept dark until time for gathering them, when a light is thrown on a screen and they throng to the light. The ladybugs are delivered in capsules, ten insects to a capsule, and one capsule is placed in each infested tree. The ladybugs begin their war of extermination almost immediately and clear an orange grove of mealy bugs in a remarkably short time. The insectary is provided with an air-conditioning system that removes dirt and supplies proper humidity and temperature, and the plant itself is insect-proof in order to keep the ladybugs safely in and other bugs out.

Potato Sprouts on Which Larvae of Ladybugs Are Grown; Nursery, and a Handful of Ladybugs

CROSSED EYES ARE CORRECTED BY STEREOSCOPE DEVICE

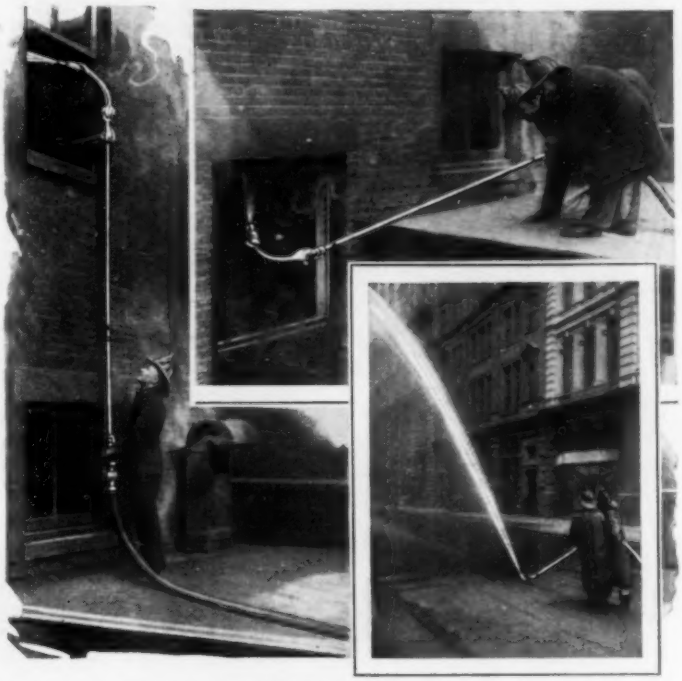
Crossed or squint eyes are being aided by an apparatus somewhat like the ordinary stereoscope which has been developed by an English doctor. The device does not replace former methods of correcting

by glasses, prisms or operations, but merely supplements them. Suspecting that many cases of squint are due to the persistence of the infantile inability to co-ordinate the movements of the eyes, the doctor developed an apparatus to discourage the tendency of each eye to act separately. He employs the hand of the patient to educate the erring eye, thus imitating the natural process of infancy in which hand and eye mutually perfect their training by trial and error.

SUSPENSION WINGS TO ELIMINATE AILERONS

Ailerons are entirely lacking on what the inventors term a fool-proof airplane recently demonstrated on the Pacific coast. Instead of using ailerons to provide lateral balance, this task is performed by what are known as "free suspension" wings, attached at right angles to the rear surfaces of the flying wings. This arrangement, it is claimed, causes the ship to assume the proper landing position automatically at the moment the power is shut off.

Airplane with "Free Suspension" Wings, Which Cause Ship to Assume Proper Landing Position



Various Applications of a Fire Hose with an Extension Nozzle, Capable of Making a Powerful Stream of Water Turn Corners

WATER MADE TO TURN CORNER BY NEW FIRE NOZZLE

Capable of making a stream of water turn corners, thus enabling firemen to launch a flank attack on a blaze, an extension nozzle for a fire hose also serves in emergency as a miniature water tower. It consists of an ordinary nozzle mounted on a length of flexible brass tubing, which in turn is connected to a rigid extension of stainless steel, nine feet long. Between the hose coupling and the extension are two valves which control the direction of the nozzle and the size of the stream. When the end is bent to turn a corner, the flexible tubing is held in position by an aluminum casing. One man operates a lever which turns the nozzle in any desired direction, and another controls a valve which varies the stream. The nozzle is equipped with a removable stand so that the operator can place the nozzle in an aperture a story or more above him, thus transforming the apparatus into a small water tower. The long nozzle enables firemen to cope with smoke, flame or heat without getting in their path.

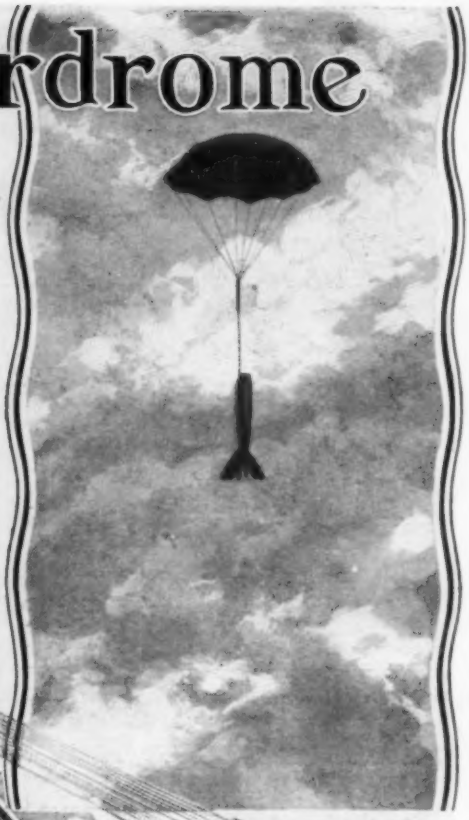
The World's First

At Tempelhof, near Berlin, Is a Rocket Airdrome, a Field Equipped for Studying Rocket-Propelled Air Vehicles; from These Tests the Experimenters Hope Eventually to Develop a Practical Rocket-Propelled Airplane, and to Find Out Much about the Atmosphere Many Miles above the Earth; at Left Is Shown an Explosion as a Rocket Is Fired, and a Projectile Being Placed in Its Mounting

Above Is an Observation Post Protected by Sand Bags from Which the Experimenters Watch the Firing of One of the Test Rockets, and, at the Right, a Man Is Engaged in the Highly Hazardous Task of Filling One of the Rocket Cartridges with Liquid Oxygen; Because of the Danger Involved, He Wears an Asbestos Suit for Protection in Case of a Premature Explosion

Copyright, Z. Kluger

Rocket Airdrome



Erecting the Stand on Which the Rocket Is Mounted, and, at Right, a Parachute Carrying an Exhausted Rocket Back to Earth with the Apparatus Which Has Recorded Its Flight; the Parachute Is in Its Nose, and Opens When the Rocket Has Spent Its Force and Begins Falling

Below, Listening to Signals from an Automatic Radio Transmitter on a Rocket in Flight; by Turning the Loop Aerial, the Operator Follows the General Path of the Projectile as It Falls, Thus Locating It More Easily

Left, Operator Wearing Heavy Asbestos Suit Ready to Fill One of the Rocket Cartridges with Liquid Oxygen

W. v. Szigethy

Gas Water Heater and Garbage Burner Combined; Burning Refuse Helps Heat Water

GAS WATER HEATER COMBINED WITH GARBAGE BURNER

For the home or apartment building, a gas water heater and an automatic garbage burner are offered in one compact unit, the same fuel that heats the water also disposing of the garbage. The double-duty appliance comes in four sizes for basement, first-floor and apartment installations, and the connections are the same as for any water heater. A thermostat maintains constant water temperature and regulates the burner. Garbage is deposited in a special hopper where it is under a constant drying temperature of 130 degrees, and is subjected to intermittent drying and slow burning until it is finally consumed. Heat generated by the burning garbage is absorbed by the water storage surrounding the hopper so that there is no waste of heat. The hopper is removable to facilitate grate repairs.

BEARS HUNTED WITH SHOVELS WHEN IN HIBERNATION

Shovels are used for bear hunting by natives in certain sections of Virginia during the hibernating season. The small black bears frequently hibernate in shallow mounds covered only by a blanket of leaves and snow. They make distinctive mounds which the hunters investigate by digging. Dogs then hem in the slumber-dazed creatures until they are shot. Even outside the hibernating period, bears are hunted there with shotguns rather than rifles. A ball cartridge is used, a single large shot replacing the usual shotgun charge. Another method is to "ring" the shell by cutting almost through the cardboard between the wads separating shot from powder, so the charge leaves the barrel as a unit.

MINIATURE OF BRICK RESIDENCE IS CONSTRUCTED OF WOOD

Working in spare time for more than four years, a Philadelphia man has built a miniature model of a fine brick residence in that city which is complete in every exterior detail so far as appearances are concerned. The walls are of one-half-inch white-pine wood painted red, and then blocked out by hand to give the brick effect. Shingles on the roof are glued, rain spouts are made of "bean shooters" like those used by small boys, and the side veranda is made of an organ-top board. The structure is twenty-six inches high, forty-two inches long and twenty-four inches wide, with a servants' quarters adjoining in the rear, and contains forty-three windows and six doors. The builder's only tools were a jigsaw, plane, hammer and pocketknife, but the porch columns were turned in a sawmill.

Miniature of Brick Residence with Walls of White Pine Painted and Blocked to Imitate Bricks

LIFT-BRIDGE FLOOR OF NON-SKID CONCRETE SLABS

Pre-cast slabs of lightweight concrete form the flooring of the recently completed double-leaf trunnion-bascule bridge over the Chicago river at Wabash avenue in Chicago. This type of flooring has been widely used in stationary structures because it prevents skidding, but it has only recently been applied to lift bridges. The flooring units have an area of 102 square feet and the work therefore was quickly done. They were first bolted to the steel framework, then permanently attached by means of flanges projecting from the slabs which were welded to the bridge frame. The slabs are five and three-quarters inches thick, the lower four inches being made of light aggregates of burned clay and shale instead of stone, giving the concrete a weight one-fifth less than the usual kind. The top is of granite chips to give long wear.

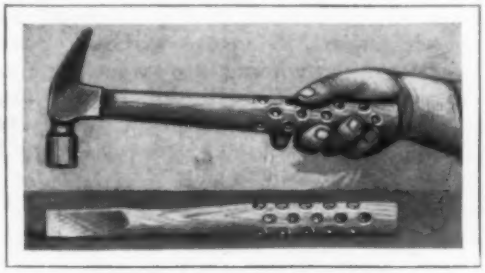
Lift-Bridge Floor of Non-Skid Concrete Slabs; Before Floor Was Laid, and Placing a Slab

LACQUER-COATED WALL PAPER IS EASILY CLEANED

Expensive wall paper can be kept clean easily if coated with a special wall-paper lacquer which is quick-drying and transparent. It is applied with a brush and the resulting surface is non-porous and resists both air and water. Once the lacquer is applied, the walls offer no greater problem in cleaning than a painted surface, although a cleaner ordinarily is used instead of water because streaks left by the cleaner are easily removed.

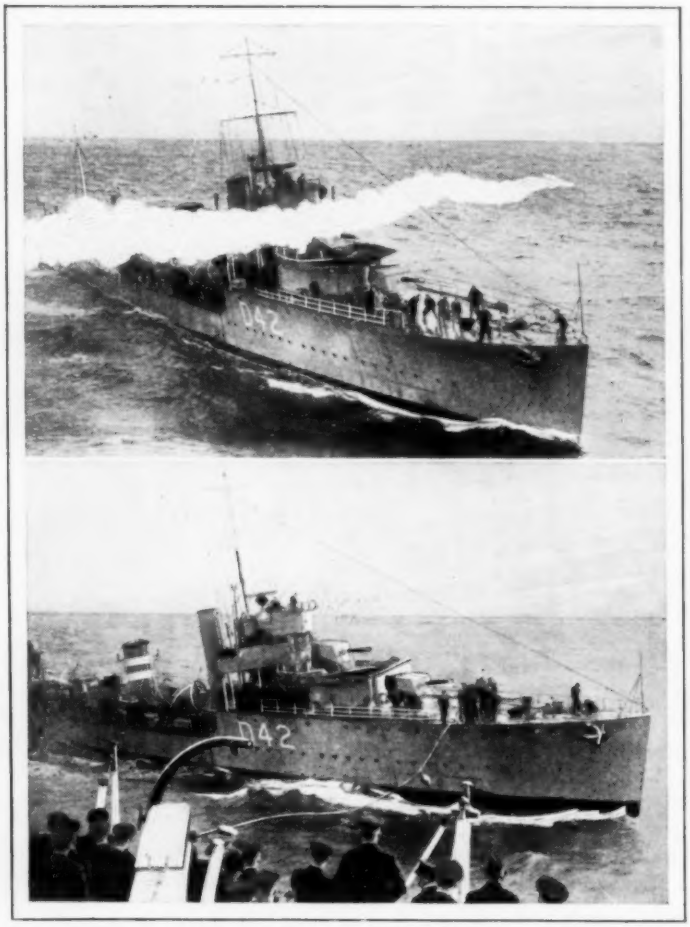
VACUUM GRIP IN TOOL HANDLE MAKES WORK EASIER

Tired hands and arm muscles from using hammers and other tools are prevented to a great extent by a tool handle with a vacuum grip. The sides of the handle contain depressions which form a vacuum when the hand presses against them. It is claimed the handle prevents calluses, since it is not necessary to grip it so firmly and friction is reduced.



Tool Handle Containing Depressions in Sides Which Give a Vacuum Grip, Easy on the Hands

¶Cotton gets its name from the Arabian word "qutn."



Line Being Fired from Battleship to British Destroyer; Below, Making Transfer of Mail at Sea by Means of the Line

BOATS TRANSFER MAIL AT SEA BY USING GUN AND LINE

Mail was recently transferred at sea from the British battleship "Nelson" to the destroyer "Windsor" without either boats or crews coming into direct contact. A gun aboard the battleship fired a line which fell across the bow of the destroyer. The line then was used to convey the mail pouches from ship to ship.

PHONE-CALL REGISTER TAKES RECORD OF NUMBER

Automatic, or dial, telephone systems now can be equipped with recorders which take down the number of a party calling when the subscriber is absent, enabling the latter to call back on his return. All the party that is calling needs to do is dial his own number when he gets no response. This number then is recorded on a paper tape by the silent phone. The register consists of a specially arranged pen-register and switch to connect the device to the telephone line. This switch is thrown when the subscriber leaves the office. Ringing of the telephone energizes a magnet in the recorder which starts a spring-driven mechanism that operates the feed of paper tape. The operation of this mechanism also sends a buzzer tone back over the line to inform the party calling that the subscriber is out. He then dials his own number, which is recorded on the tape.

BURLAP PROTECTS SHADE TREES

While studying control methods for the gypsy moth, a pest of shade trees, government workers discovered that a burlap band, tied around the trunk, made an excellent trap for the caterpillars. Strips of burlap, about eight inches wide, were tied around the tree with twine, the top half being folded down over the string. Large numbers of caterpillars can be caught in these traps and only a short time is required to crush those that take refuge under the burlap, which may be installed in the early summer, preferably any time after June fifteenth.

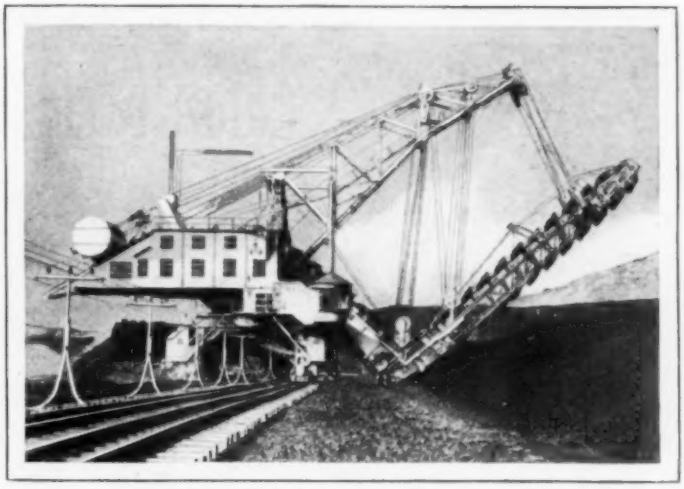
RADIUM RAYS MORE EFFECTIVE THAN X-RAYS

Although radium rays and X-rays cause reddening of the skin to the same extent, the radium is about three times more effective in producing deep-seated effects. This conclusion has been reached by two scientists who constructed apparatus to measure equivalent, comparable doses of the two radiations. It was found 500 Roentgen units of radium gamma rays produced the same reddening of the skin as 600 Roentgens of filtered X-rays. Other experiments were made on wheat seedlings. In both cases the effect of the radiation was shown as a stunting of the living shoots or cells, but three times as much X-ray radiation was required to produce an effect comparable to radium. For this reason, it may be desirable to use higher voltages with X-rays for medical purposes.

BICYCLE AND SLED COMBINED FOR TRAVEL ON ICE

One twelve-year-old New Jersey boy has taken his place with the inventors by combining his sled and bicycle into one serviceable vehicle for use on the ice or in snow. Removing the front wheel of his bicycle, he attached the forks to the rear of his sled.

Bicycle and Sled Combined into One Vehicle for Travel on Ice by Twelve-Year-Old Inventor



Giant Power Shovel Which Loads Cars in Germany; It Can Move More Than 850 Cubic Yards an Hour and Is Eighty Feet High

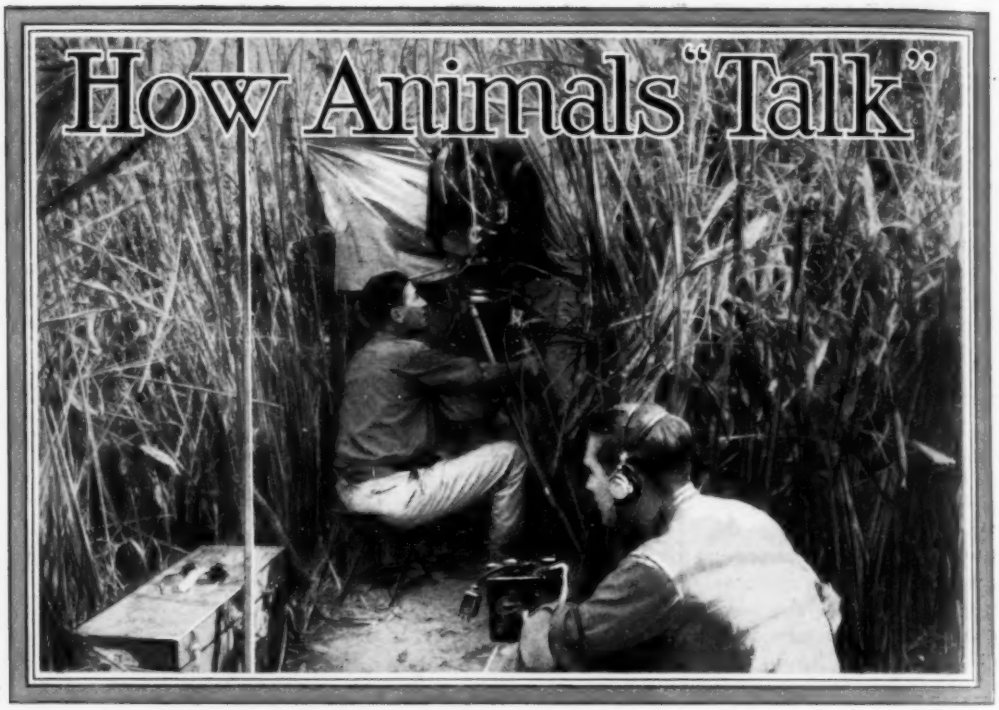
GIANT POWER SHOVEL LOADS CARS AUTOMATICALLY

One of the largest power shovels ever built is being used in Germany to load coal cars. The belted scoops run on rails, and the giant shovel itself is big enough to straddle a pair of railway tracks so cars can be run beneath it for filling. It is more than eighty feet high and can handle over 850 cubic yards of coal an hour. The shovel ladder has a reach up or down of some fifty feet, so that it can handle a pile of coal 100 feet high from one position.

FLIES COSTLY TO THE MOVIES FORCING RETAKES

Common flies, the ordinary household pests, are one of the costly scourges of the moving-picture industry. One director estimates that flies cost the movies from $4,000 to $10,000 a day in retakes. Hundreds of feet of film may be spoiled at the last minute if a fly appears on the nose of an actress in a close-up. Flies appear to have an uncanny ability to enter the movies exactly at the climax, and light on an actor or a lens. Since the advent of the talking pictures, the fly has made an additional nuisance of itself. Two of them playing tag near a microphone record like a big naval engagement. A number of men are employed in Hollywood solely to chase flies off sets.

How Animals "Talk"



Men with Movie Camera and Sound Apparatus Screened in Ambush and Awaiting Tiger, to Make a Sound Picture of the Animal in Its Natural Habitat

SHOUTING hysterically, a perfectly sane young man cavorted on the banks of the beaver pond in the New York Zoo. Suddenly he stopped, silent and unmoving. An instant later, from the nearest beaver, there came a peculiar loud splash.

"Beat it, beavers," it signaled.

Startled by the man's frenzied activities, the sentry of the beaver colony had given the curious warning splash with its tail. In another minute every one of the industrious animals had disappeared. Behind a near-by bush, however, a motion-picture camera had been grinding away while sound apparatus had recorded the "voice" of the beaver. With the alarm slap, the beaver picture was completed. It had taken three years to make.

Dr. Raymond L. Ditmars, curator of the zoo, has just finished making an extraordinary series of talking pictures with an all-star cast of animals and reptiles. The voice of the rattlesnake, the roar of the lion, the trumpet of the elephant, the bellowings of the giant tortoise, the grunt of the hippo, the hiss of the cobra—these and other articulations of the usually silent animal world have been secured through a variety of ingenious stratagems and despite often dangerous obstacles.

With the increasing perfection of sound and reproducing equipment, has come a growing number of attempts to record the authentic enunciations of animals—a most difficult task, in the face of their customary reluctance to vociferate. Yet, not only in zoos but in the jungles of Africa, India and South America, beasts are "talking" before hidden microphones. The Martin Johnsons, the members of the Matto-Grosso expedition and other explorers, scientists and sportsmen are now engaged in making talkies of ungentle, uncaged animals in their natural environments.

The first to make these sound pictures of jungle beasts, Comm. George M. Dyott, returned some months ago from an exploration in little-traveled regions of northern India, where he succeeded in making pictures of barking deer, screeching peacocks, growling Himalayan bears, whistling birds, wild pigs, langur monkeys and sundry jungle fowl. He concentrated, however, on carnivorous tigers,

A Variation of the Tiger Set-Up; Commander G. M. Dyott, with Special Camera, Stands Where He Can Watch the Area and Direct the Hidden Movie Men

leopards and elephants. Commander Dyott's new expedition to the hazardous Xingu river country in Brazil, will have two airplanes and wireless equipment, in seeking to secure talking pictures of other jungle animals.

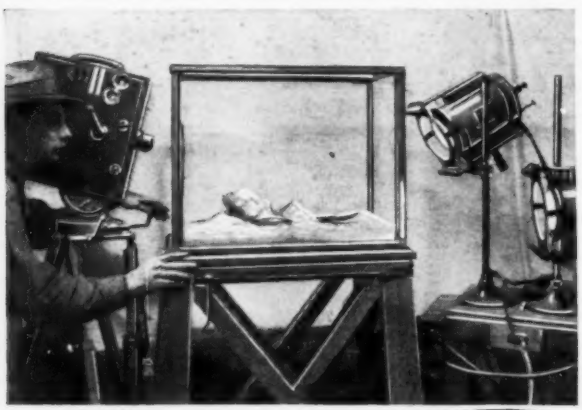
Getting the ferocious, untamed denizens of the jungle to pose and talk naturally before camera and mike is no simple task. The difficulties are so enormous and the process so delicate that, as Commander Dyott declares, it is only a matter of luck when a sound picture of an animal is successfully taken.

To make a tiger talk, for example, will often take weeks of preparation. You can't say "There's a tiger"; walk over to it with camera and sound apparatus, and shoot the picture. The beast must be forestalled, and awaited with all the mechanism carefully set up and cleverly screened from view. Places which the tiger is known to frequent are chosen as "locations" for pictures. A study of the animal's habits—perhaps the discovery of a scratched tree-trunk on which it is accustomed to sharpen its claws—will determine the exact scene of the drama.

Fifteen feet or more from the tigers, screened behind a grass framework made to resemble a part of the jungle, cameraman, sound man and director dare not move an eyelid. It is only because of the tiger's poor sense of smell that they can thus remain undetected and catch the tiger and its family "talking" naturally at their festive board. With the tiger's appetite aroused, the discovery of a human being in the immediate neighborhood would not be conducive to that person's health.

Because of the numerous difficulties and hazards to be overcome before an animal can be made to talk, Commander Dyott spent more than four months in getting only a thousand feet of film. Although the sound apparatus was made specially compact for him, it was not easily portable and required the greatest care in setting up. Then, of course, the beasts must somehow be persuaded to come sufficiently close to the mike to register loud enough; all this without the subject being aware of the presence of camera or humans.

Great difficulty is encountered in reproducing the low-frequency sounds of



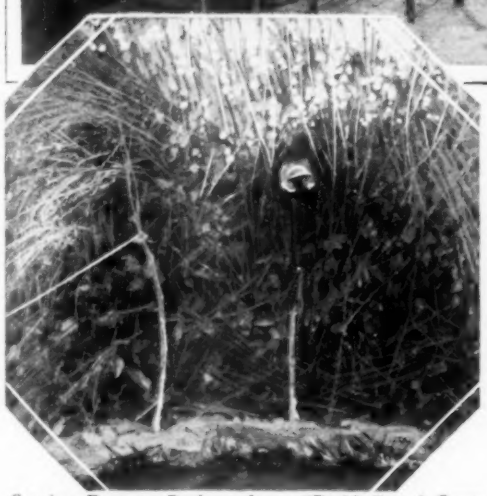
guttural bass, noises—the tiger's roar, for instance—on the screen unless there is special amplification for this purpose. With the animal's utterances and movements completely uncontrolled, it is hard to adjust the amplifier correctly. Besides, no animal can be made to talk by artificial means. They are naturally silent in order not to attract their enemies. Birds can afford to be noisy; they are on the wing. The only sounds animals make aim to demoralize adversaries and to call their mates. It is no wonder, then, that even in the zoo, the curator found it impossible to record the voices of the wolf, the alligator and the peacock.

With animals in captivity, methods different from those used in the jungle must be employed, though it is often just as arduous a proposition to make them vociferate. Nevertheless, before making his pictures, Doctor Ditmars succeeded in getting some of his charges to go through talking screen tests. The rattlesnake, he found, had the best speaking voice, while the lion had the poorest. Monkeys had particularly good intonation, while insects' sounds reproduced very faithfully.

In contrast with the elaborate method of inducing the tiger to talk in the jungle, Doctor Ditmars' device for forcing the tiger's or lion's roar is remarkably simple. A large meaty bone, to which a long wire is attached, is thrown to the beast. In the midst of its enjoyment of the meal, it is suddenly yanked out of its mouth. The subsequent tremendous roar of anger is caught by the hidden microphone and synchronized with the picture.

The elephant speaks either in little squealing

Making Sound Film of Crickets, Close View of One of the Tiger Shots and Captured Elephant Making an Abundance of Sound



Coaxing Dogs to Perform for a "Barkie," and Grass Screen Used in Filming Tigers

sounds or loud trumpets when it is excited. With the captive elephant, the mike is placed in a pail, and the animal puts its trunk down into it, talking back to the keeper who addresses it. In the jungle, on the other hand, the elephant is often dangerous. If disturbed or surprised, it is always likely to attack. Its sense of smell is so keen that it can detect something a mile away. Hence, it is necessary to work to leeward of it.

The fer-de-lance, one of the deadliest of poisonous snakes in the zoo, enacted a perfect, though somewhat hazardous, performance for the audible screen. In order to get the buzz of the tropical viper, the recording instrument was placed within two feet of its vibrating, quivering, rattling tail. The exact striking distance had to be carefully calculated and Doctor Ditmars and his assistants had several narrow escapes from the lunging snake. Similar danger was ever-present in the recording of the loud, sharp hiss of the cobra in a fight with a mongoose.

To persuade the tree toad, which has a two-inch throat, to sing for the talkies, every known artifice was tried in vain. Finally, four men started to file on pieces of brass, producing an ear-piercing racket. It proved irresistible. When the tree toad's throat began to swell, the men stopped filing, and the shrill, deafening song of the toad was successfully recorded. Purely by accident, the tree toad provided an exceedingly funny scene for the talkies. Its enormous forefeet got entangled in a piece of cord with the result that its subsequent acrobatic antics became a hilarious farce.

Monkeys are natural comedians. About fifty varieties of monkeys were photographed by Doctor Ditmars, who found the marmoset, which has a voice like a bird, the star of the lot. The curator merely lures his monkeys with food and talks to them. They jabber back, right into the mike.

The easiest voice to record is the sea lion's. It will bark whenever it is hungry, and do it unabashed close to the micro-

Observation Platform Rigged in Tree for Filming Sound Pictures of Animals in the Jungles of India

phone. The giant tortoise of the Galapagos islands will bellow at a certain time of the day. It is also easy to get a close-up of a hippopotamus, which makes a sound naturally about once a week—a mere grunt. Bears, normally dignified and reticent, will get noisy when a battle among them is instigated.

Most animals, however, have stage fright, and as a rule the sight of a camera, or merely the feeling that something is happening, is sufficient to make most animals refuse to talk. Many months were spent in vain in the Bronx Zoo trying to get wolves to howl while standing on the rocks. Nor have Doctor Ditmars and a number of newsreel companies been successful in getting the albino peacock to spread its beautiful wings and articulate before camera and mike.

One of the best talking pictures made in the zoo was that of the prairie dogs. When the sentry lets loose a long, shrill cry, the entire crew rushes to its holes. A constant chattering is taken as a warning—"stand ready to beat it." A long whistling sound, and then another very prolonged sound, mean "all's well." One "eek," and they all scurry to shelter. The entire picture in sound took about a year to make.

The most successful sound picture taken was that of a chorus of katydids. These tree-top songsters, a couple of inches long, produce the greatest volume of sound in relation to their weight of any insect or animal. On a still night, its voice will carry for half a mile, yet it is so timid that it stops singing when someone approaches.

Capturing the katydids was not an easy job. The curator and his assistants had to go up to the Catskill mountains to hunt for them. On a dark night, they placed a huge umbrella beneath small scrub-oak trees, about six or seven feet high, and shook the trees. The katydids fell into the umbrella. Sometimes, when the insects stopped singing as they saw the flashlights approach, the hunters had to wait for an hour or more until their song was resumed. In his studio, later, Doctor Ditmars was able to photograph clearly the rubbing together of the katydid's wings—that peculiar sawing which produces the sound similar to that of fiddle strings.

MANGANESE IS NOT ESSENTIAL FOR VEGETABLE LIFE

Manganese, strengthener of steels, recently believed to be equally important as a vivifier of green plants, may not be as universally necessary for vegetable life as has been assumed. Experiments at Iowa State college lend support to the

doubters of the importance of manganese for green growths. To simplify procedure, tests were made with a floating water plant known as "Lemna." This seemed to thrive without that element.

COMBINE WITH WIRE CYLINDER SPEEDS UP HARVESTING

Harvesting and threshing of small grains has been speeded up by a combine which is equipped with a wire-brush cylinder instead of the conventional steel cylinder and concaves. The combine takes a five-foot cut and is so small that it will work anywhere a binder can be used. Its wire-brush cylinder, five feet long and eighteen inches in diameter, turns at 1,000 revolutions per minute, this motion beating the grain out of the head. Grain severed by the cutter bar is carried to the cylinder, and the kernels are whisked out as the straw passes over the brush. The straw falls to the ground and the grain is carried by an elevator to a separating device. Since eighty per cent of the straw never enters the separator at all, the combine can handle any length of straw without difficulty. It is pulled by a tractor and operated by a power take-off, one man handling both machines. A governor on the fan automatically controls the air blast, increasing the size of openings and air flow if the outfit slows down.

Combine Equipped with Wire-Brush Cylinder, Which Beats Out the Grain as the Straw Passes over the Brush; One Man Operates It

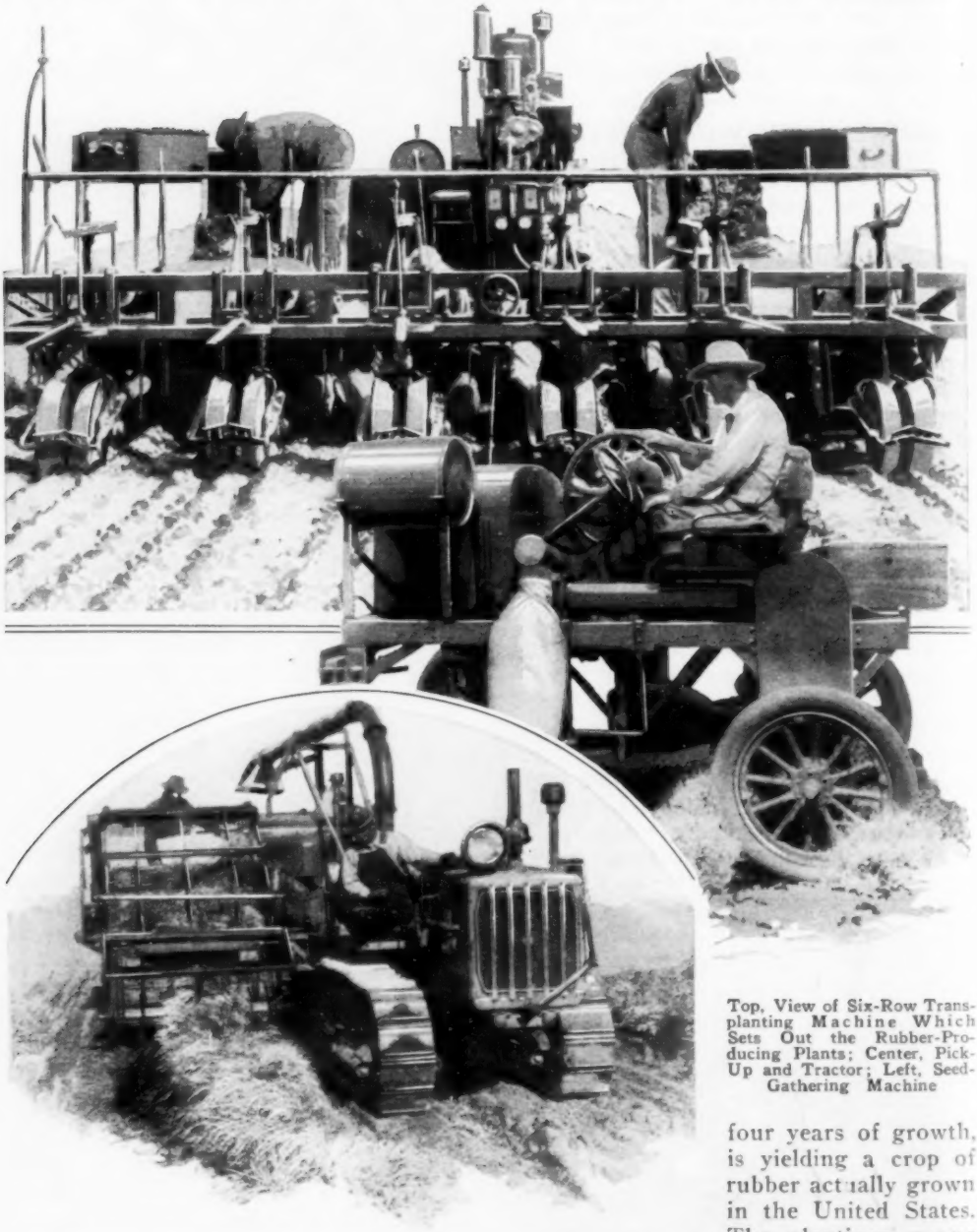
Skull and Neck of Prehistoric Reptile Found on Texas Farm, and Drawing of Complete Skeleton

SKELETON OF ANCIENT REPTILE FOUND ON TEXAS FARM

One of the best preserved skeletons of the prehistoric plesiosaurus ever found was discovered quite by accident recently in the mud of a pig pen on a farm near Dallas, Tex. The remains of this long-necked seagoing reptile were disclosed after the pigs had uprooted a front flipper of the gigantic specimen. Excavations soon unearthed a skull, a foot and a half long, attached to a twenty-five-foot neck. The full length of the beast was estimated to have been from forty to seventy-five feet. It lived some 20,000,000 years ago and probably weighed 50,000 pounds. The skeleton will repose in one of the buildings of Southern Methodist University.

¶Automobile owners pay gasoline taxes of $500,000,000 a year, in addition to $350,000,000 for registration and license fees.

FIRST RUBBER CROP HARVESTED IN CALIFORNIA



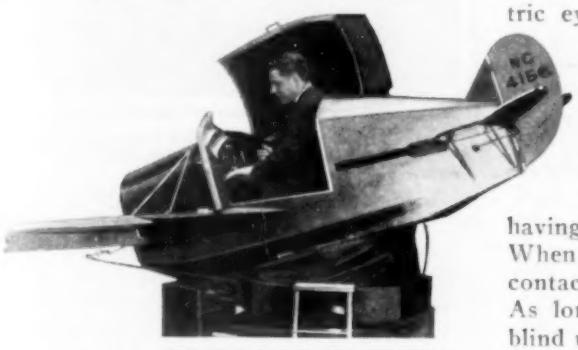
Top, View of Six-Row Transplanting Machine Which Sets Out the Rubber-Producing Plants; Center, Pick-Up and Tractor; Left, Seed-Gathering Machine

California this year is harvesting its first rubber crop resulting from the commercial planting and cultivation of the Guayule shrub, native of the high semi-arid plateau of central Mexico. This plant was introduced into California after seventeen years of research, and now, after four years of growth, is yielding a crop of rubber actually grown in the United States. The plantings were started in the Salinas valley in 1926, when 200 acres were set out, and plantings to date are 6,000 acres. The care and cultivation of these shrubs have now been entirely mechanized, machines performing all the operations from transplanting to harvesting. The plants are raised from

seeds in nurseries and, after a year's growth, are transplanted to the fields in early spring, about 7,200 plants to the acre. In the field, cultivation and weeding are required. Four years after transplanting, the shrubs are mature, being about two feet high and resembling sagebrush. The shrub is a hardy miniature tree that not only withstands frost, but requires the periods of rest or dormancy thus induced. The plant yields a rubber content of about sixteen per cent, to extract which the shrubs, including the roots, are ground in mills containing water, this operation releasing and agglomerating the rubber which is then recovered by a flotation process. Guayule rubber is not a new product as it has been produced and marketed from the wild plants since 1906. The shrubs yield from 1,000 to 1,500 pounds of rubber to the acre in four-year cycles, whereas the tropical hevea tree must be cut 180 times a year to give four pounds of rubber. A ton of rubber can be produced in the United States with an expenditure of only one-sixteenth the effort required to produce a ton of plantation rubber.

MAKING BLIND FLYING SAFER WITHOUT LEAVING GROUND

Student flyers can be trained in "blind flying," or piloting an airplane by reliance on instruments alone, with an apparatus which offers the hazards of actual flying conditions without leaving the ground. It consists of an airplane fuselage and cockpit mounted on a movable base. The student, in the hooded cockpit, controls the machine by using his instruments.



Plane for Ground Training in Which Student in Hooded Cockpit Learns "Blind Flying" before Going into Air

© Planet News, Ltd.

Walking Stick with a Flashlight in Its Tip, and Another Provided with a Cigaret Holder

ELECTRIC LIGHT IN TIP OF CANE POINTS WAY IN DARK

For finding the keyhole, a house number or even lighting the way at night, a walking stick is being offered with a tiny electric light in its end. Each time the cane touches the ground it makes a contact with a switch which lights a bulb. Another walking stick is provided with a cigaret holder.

ELECTRIC EYE SEES FOR BLIND BY GIVING DIRECTIONS

Electric eyes now are being used to "see" for blind persons in guiding them about their homes by giving them a sense of direction as they move about. The electric eye, or photo-electric cell, is made up like a flashlight with a small buzzer connected to its battery. Convenient electric lights are then placed about passages and hallways, particularly at turns. The blind person turns the electric eye about much as a person having his sight would direct a flashlight. When the device points to a light source, contact is made and the buzzer sounds. As long as the buzzer is sounding the blind user knows he is on the right path. In similar fashion a window through which light is streaming may be located.

Poor

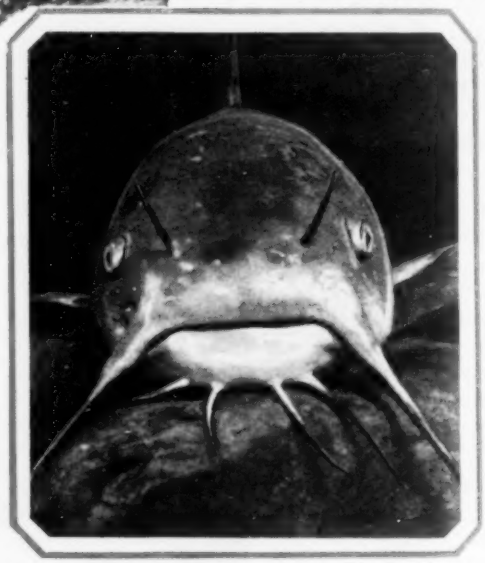
A CENTURY ago the government built a fort at the southern end of Manhattan, but when the fear of invasion subsided, the building was converted into an aquarium. Sixty million people have already passed through its doors and have seen the thousands of fish kept there.

Some fifty aquaria spot the globe and annually attract approximately 75,000,000 people. This is no small percentage of the world's population, and surely indicates how conscious we are of the poor fish who come out of the sea to live in tanks.

Considered one of the world's largest aquaria, the New York fish zoo has served as a model for many others. Its present population is 5,454 specimens divided among 246 species.

Charles H. Townsend, director, makes a startling comparison between zoological gardens and aquaria. "The annual cost," he said, "of keeping up the collections of this aquarium, probably the largest institution of its kind, is less than the cost of a single giraffe, rhinoceros or elephant. The cost of food is negligible compared with that expended for a zoological garden."

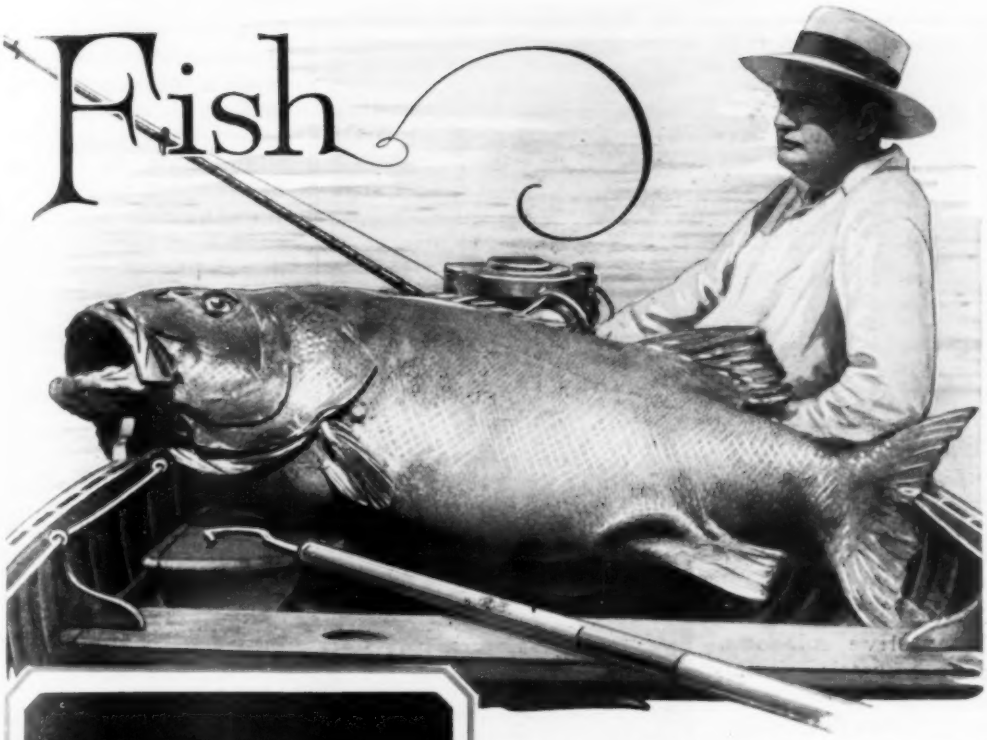
While Townsend's figures hold well for seaboard cities, the original cost and maintenance jump prodigiously for inland cities. Thus, Chicago, desiring to stock an aquarium 1,000 miles from the sea, faced peculiar problems in transporting specimens and sea water. It costs the Chicago aquarium about ten times the purchase price to place a specimen into an exhibition tank.



Top, a Balloon Fish Which Has the Power of Distending Itself; Below, an American Bullhead

Even seaboard aquaria worry over the high price of bringing rare specimens from the hunting grounds. Water tanks to keep the specimens alive are enormously heavy, and since they cannot be sent by slow freight, they travel on the fastest passenger vessels under the care of trained

Fish



Top, a **Fine Specimen of the Jewfish, Weight 184 Pounds; Below, Grotesque Dogfish Found in Brazil**

attendants. While its original cost may be slight, the specimen becomes valuable by the time it goes on exhibition.

If water circulation cannot be maintained while the tanks are en route, they must be aerated artificially. It costs more to transport one big sturgeon or shark than 500 small fishes. It is cheaper and less hazardous to send a shipment of crabs to England than to bring one good-sized sturgeon from the Delaware river.

Fish collectors frequently preserve specimens by shipping them in oxygen containers. Thus numerous small fishes and invertebrates have been sent from New York to Germany—a nine-day trip. Jars filled with water are inverted under water. Oxygen gas is allowed to displace one-third of the volume. The jars, corked and covered with tight parchment, are then ready for shipment.

Of course, fish get hungry, and the aquarist's great concern is finding the proper food for his charges. Most fishes can be kept happy if fed only once in forty-eight hours. The principal foods are meat, chopped, sliced or minced, to suit the mouths of different specimens; then clams, and various sorts of fish, both dead and alive. The principal food fishes are cod and herring. In a typical month, the 5,000-odd fishes consumed 2,160 herring, 5,200 clams, thirty-nine pounds of shrimp, twenty-five pounds of butterfish and twenty-eight pounds of beef heart, at a total cost of $322. But other food was consumed which the aquarium does not purchase. During the summer months,

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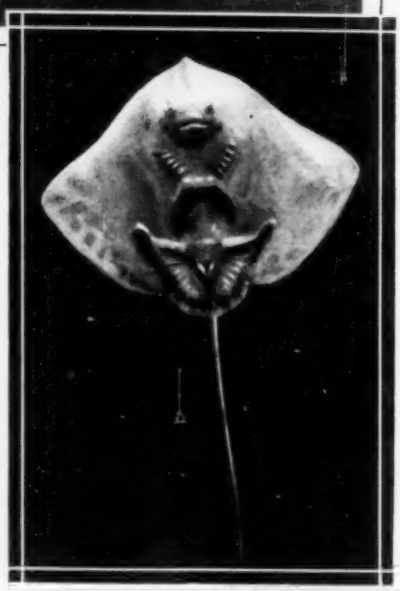


Top, Japanese Fringetail Goldfish; Below, a Thornback Skate

its collecting boat brings live minnows, crabs, mussels, marine worms, small soft clams and "beach fleas" from adjacent waters.

The sea horses are the most difficult specimens to feed. In addition to requiring circulating water, they demand live food. Young trout and salmon in the fish hatchery are fed minced liver and beef heart. They also like herring roe. By feeding whitefish on a menu of herring roe and mosquito larvæ, the New York aquarium succeeded in raising specimens from infancy to an age of ten years.

The sea cow or manatee likes lettuce and cabbage trimmings, but would rather munch salt-water eel grass. The manatee devours fresh bread also; one specimen consumed ninety bushels of eel grass and twenty bushels of pond weeds during five months.

Feeding is a most important consideration in aquarium management. Some virile-looking fish are really as sensitive to food and environment as are delicate flowers. The problem is to supply them with the most natural foods. And they also demand a somewhat varied diet.

Just how important it is to watch the feeding habits of fish is shown by the aquarium's experience with dogfish and dog sharks. Neither was able to survive tank life more than a few months, until it was found that what they really needed was more bony material in their food. And now these fish live inside a tank for years.

The aquarium keepers are on constant guard against parasites. Worms attach themselves to the gills of the angel and butterfly fishes, causing death. By long observation it was found that certain fish, apparently, rid themselves of parasites by sucking sand through their mouths and throwing it out through the gills. At any rate, aquarists recognize the supreme wisdom of spreading loose sand over the tank bottom. Captive fishes may frequently be seen rolling in sand or taking a sand "rub-down." Some species acquire the habit of settling into the sand and showing little more than their eyes. The flounders and skates hide this way for hours, and wait for prey.

Fresh-water turtles also seem happier when wallowing in loose sand. Turtles and other cold-blooded reptiles need direct sunlight during at least part of the day and will not feed in winter unless kept in warm water.

The mud-loving fishes present a problem. If allowed to swim in muddy water, spectators would be unable to see them. However, the keepers remove them from

the clear-water exhibition tanks occasionally and allow them to swim in real muddy water. Sudden deaths among trout have been checked by transferring specimens to muddy waters.

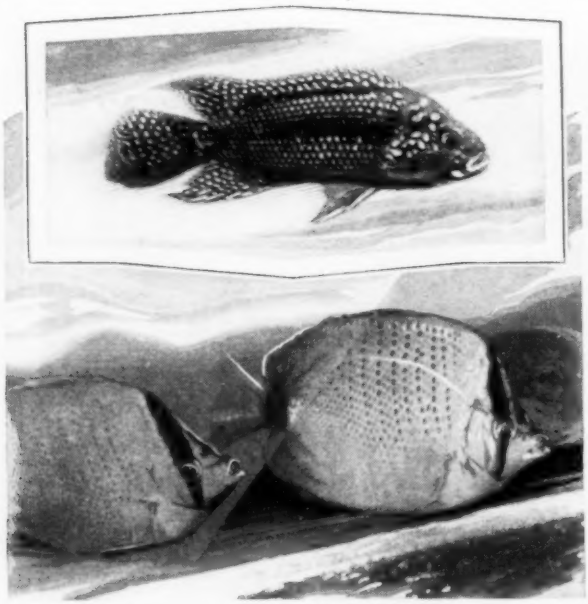
A group of fish in one tank usually become so accustomed to each other's company that removals or additions cause them no end of worry. When out of humor, they may fight or cease to feed. Then the aquarist realizes that he has disturbed the balance. A tank of "well-set" fish had best be left alone. This holds true for marine fishes especially. Once, when a large queen triggerfish was introduced into a tank, it was immediately attacked by the regular inmates.

Certain tropical fishes have the peculiar habit of feeding only at night, and they will not eat properly if the food is thrown into the tank during daylight.

Moorish Idol Fish; "Butterfly" Cod: Black Veil Tail

How good is the treatment accorded fishes in the aquarium? It is as good as human ingenuity has thus far been able to devise. If one examines case histories in the New York aquarium, one finds records of gar, mudfish and striped bass which survived tank life for twenty-four years. On the other hand, fragile specimens have collapsed five minutes after being placed inside a tank. Rock bass, calico bass and perch have lived in tanks for more than twelve years. The aquarium's 200-pound jewfish has been a boarder for nine years. A nurse shark also swam in a tank for nine years. Many species of groupers, hinds and grunts have survived eight years. A sea lion lived nineteen years in one of the large pools, and a giant salamander liked it for thirteen years.

The longevity of fishes is directly de-



Top, the Jack Dempsey Fighting Fish; Below, Strange Species of Marine Life, Appropriately Called Puffer Fish

pendent, of course, on the environment. The ideal aquarium is undoubtedly harder to build than the ideal zoo, since fishes are so unaccustomed to land conditions.

The most important part of an exhibition tank is the glass front. This plate costs from $75 to $100 and is at least one inch thick. To set a plate requires great skill. If it does not fit snugly into the frame of three-inch angle iron, it develops cracks. It must be set so that there is even pressure on every square inch of the surface.

Aquarists recognize water as their fundamental problem. If water and food are right, the problem of caring for specimens is a small one. The natural waste products of fishes destroy the water's alkaline condition and it becomes acid. Waste products reduce the carbonates to bicarbonates, and finally to carbonic acid. By adding small quantities of bicarbonate of soda, the keepers restore the original alkaline condition.

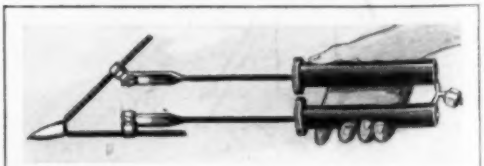
The average spectator thinks of only two kinds of water in the aquarium—hot and cold. But the New York aquarium uses seven different kinds of waters. For different fishes, the water must be kept at different temperatures. In addition to varying temperatures, the water must be aerated continually and kept circulating through the tanks and pipes. Although spectators cannot see them, the top surfaces of the tanks are open to natural daylight coming from sky windows. The amount of light streaming through these windows must be watched carefully. Some fishes are injured by excessive sunlight, and others suffer from lack of it.

FABRIC "NERVES" TEST WINGS OF PLANES

Artificial nerves in the form of fabric sensitive to heat are being used to test the air pressure on airplane wings, thus helping solve important problems in aerodynamics. These nerves consist of thin strips of a fabric selected for its rapid conductivity of heat. The strips are stretched tightly on the part of the wing surface to be tested. The harder the wind blows, the more rapidly the fabric turns cold, and sensitive instruments register the heat change with great accuracy. Such a method makes it possible to obtain direct information about conditions of flow which at present cannot be determined by direct theoretical considerations.

ELECTRIC TORCH FOR WELDING RUN FROM LIGHT SOCKET

Weighing only thirty-three pounds complete, a portable welding outfit is being offered in the form of an electric torch that provides instant heat for brazing, welding and hard soldering. Different styles operate from 110-volt alternating current, or from 220 volts, and the power consumption may be varied from 480 to 3,400 watts, depending on the work to be done. Finger-tip control provides a simple means of temperature adjustment.



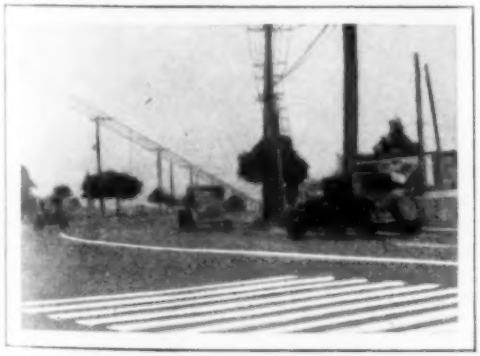
Portable Torch for Brazing, Welding and Soldering; It Operates from a Light Socket

ATOM VIBRATIONS PLAYED ON THE PIANO

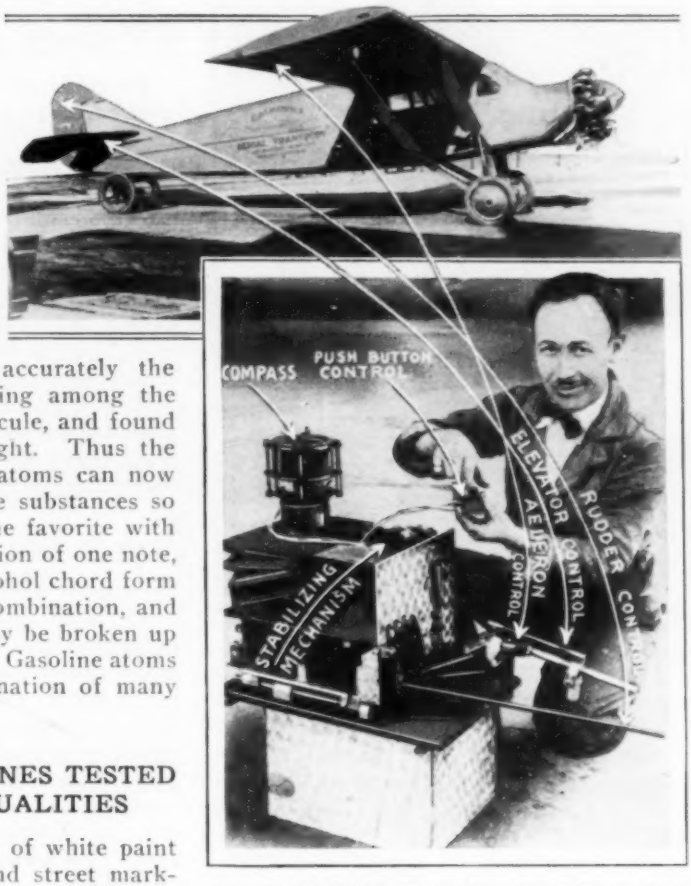
Musical vibrations of alcohol, water, gasoline and other common chemical substances have been written and played on the piano by Dr. Donald H. Andrews of Johns Hopkins university. The seductive chord of alcohol, for instance, represents accurately the various vibrations occurring among the atoms of the alcohol molecule, and found in the spectrum of its light. Thus the transposed music of the atoms can now be heard directly. Of the substances so far tried, alcohol seems the favorite with listeners. With the exception of one note, the seven notes of the alcohol chord form a well-known harmonic combination, and the tones of the chord may be broken up to give a melody or theme. Gasoline atoms make a discordant combination of many unrelated notes.

PAINT FOR ROAD LINES TESTED FOR WEARING QUALITIES

Before buying a supply of white paint for use on traffic lines and street markings, the purchasing agent of a California city tested the wearing qualities of samples furnished by several manufacturers. Each sample was given a secret number and parallel lines of each grade were painted across a heavily traveled highway, on curves, grades and at intersections.



Stripes across Road Are Samples of Paint under Test to Find the Best for Road Marking



"Iron Skull" Which Pilots Plane in Flight; It Operates by Magnetic-Compass or Push-Button Control

"IRON SKULL" GIVES AIRPLANE ADDED SAFETY

Automatic control for an airplane is provided by an "iron skull" which manipulates the controls with or without the aid of a human pilot. The device, recently demonstrated by its inventor, operates from a magnetic compass or by the pressure of a finger on two tiny tube openings in a box which can be carried to any part of the craft. Such an arrangement, according to the inventor, makes possible a one-man refueling flight, the human pilot being able to attend to the fuel hose while the robot pilot takes care of the maneuvering of the plane.

¶A noiseless window-shade roller has been invented that has a slow, steady pull, and stops and locks automatically.

Scene Modeled in a Small Gourd by Mexican Who Specializes in Tiny Figures

MINIATURES OF MEXICAN LIFE SHOWN IN TINY MODELS

Every phase of Mexican life is presented in miniature form by the official "modelista" of the national theater in Mexico City. This man forms small clay figures representing various activities, using for tools an orange-wood stick and a toothpick. His subjects range from tiny churches to even tinier barnyard fowls, and some of his miniatures are so small that half a dozen of them stand with ease on a thumbnail. One of his unusual pieces of work is a complete rural scene done in the half of a small gourd shell.

FISH FOSSILS LEAD TO WATER FAR UNDER THE GROUND

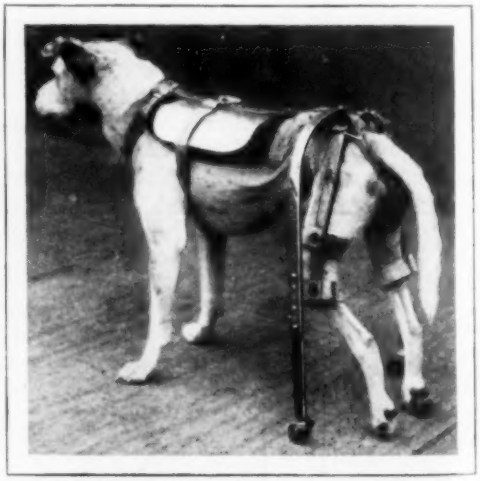
Fish that died millions of years ago are an aid to the modern geologist searching for water far underground before sinking a deep and costly well. Water usually is found beneath certain kinds of rock, and geologists know that different fossils characterize various rock formations. A drill is sunk and the expert examines with great care the fragments it brings up. The shells and fossils of fish show clearly the rock formations through which the drill is passing and indicate to the trained eye the probable distance from water.

SHEEP SKIN MAY GROW WOOL AFTER ANIMAL IS DEAD

Recent experiments show that a sheep may continue to produce wool long after it is dead. The tests were made by the research association of the British woolen and worsted industries after it was found a tiny piece of muscle could be kept alive and healthy in the laboratory by chemical means. Now it has been discovered that, if the skin of a sheep is treated in special ways, it may continue to grow wool, apparently for an unlimited period. It is even claimed that the wool is better than that which the sheep produced when alive, because the growth can be so controlled that the proper kind is produced for any particular purpose.

THIS INJURED DOG SKATES THROUGH LIFE

At least one dog is roller skating through life and apparently enjoying the experience. The animal's hind legs were paralyzed as the result of an automobile accident, and its owner made a harness to which were attached leg braces equipped with rollers. By using its front legs for traction, the dog moves on the rollers with no little speed and in apparent comfort. The owner now is trying to attach



Crippled Dog Which Goes through Life on Roller Skates Attached to a Harness

a tail-wagging brace to the harness to permit movement of this important appendage.

"HOUSE" WITH ONLY ONE WALL HELPS SELL HOMES

Front and Side Views of the "House" That Is All Front; a Building Contractor Erected the Structure to Warn Home Buyers against the Practice of Purchasing for Appearance Alone

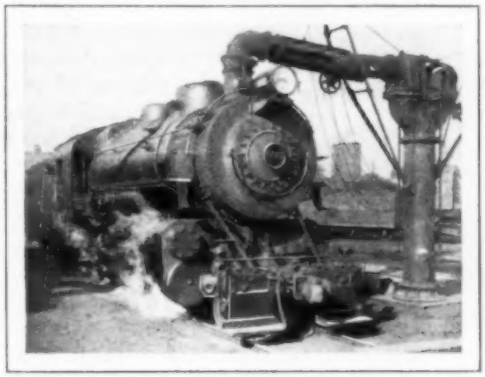
One Philadelphia building contractor has erected a single-walled "house" that is all front, to advertise his business and warn prospective home buyers against the practice of purchasing on the basis of looks only. To all appearances a direct front view shows a well constructed home with many attractive features set in pleasing surroundings. There are bowlder gate posts, broken flagstone walks, a fine colonial doorway with suitable hardware, shutters and glass in the windows with curtains hanging behind them, and at night the windows are lighted to give the appearance of a comfortable and cozy home. A view from either side of the false front, however, reveals only an open space with no semblance of a home.

SWEET GUM LATEST PRODUCT OF LOUISIANA FORESTS

Louisiana's forests now are producing a large quantity of storax, commonly known as sweet gum, from the red-gum or sweet-gum trees of that state. It is obtained by cutting the bark to the wood and letting the gum flow into cups attached to the trunks. The balsamlike or resinous exudation is used in pharmaceutical preparations, and for adhesives, incense, perfumes, soap, glove powders and for flavoring tobacco. Heretofore storax has been imported from Asia Minor. Extraction of the gum, it has been found, does not injure red-gum trees for lumber purposes.

RAILROAD-YARD SMOKE EATER DEVOURS ENGINES' DIRT

Some railroad yards in large cities are being equipped with smoke eaters to get rid of the dirt belched forth by locomotives. When engines are standing in the yards with steam up, a hood is connected to their stacks and the smoke is carried through a section of pipe where the dirt and dust are removed, before it is finally released through a stationary chimney.



Hood Connected to Locomotive Smokestack Which Draws Off Smoke While Engine Is Standing

Telephone Receivers That Exclude Noise; the Transmitter Rests against Cheek or Throat and Is Actuated by Vocal-Cord Vibrations

PHONE THAT EXCLUDES NOISE ACTUATED BY VIBRATIONS

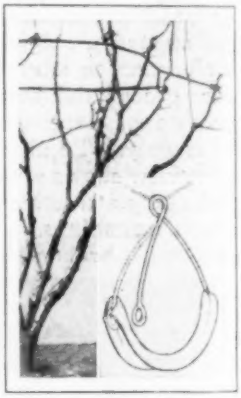
Actuated by mechanical vibrations applied directly to it, instead of by sound vibrations borne by the air, a noise-excluding telephone is being used in Europe for carrying on conversations in workshops, on ships, in mines, on airplanes and in other places where the noise would interfere with conversation. The instrument is known as a "laryngaphone," and is actually operated by the speaker's vocal cords vibrating against it. The "mouthpiece" is placed against the throat or cheek instead of before the mouth, the instrument being insensitive to all airborne noises. Picking up the mechanical vibrations of the vocal cords, the telephone transmits the voice without distortion. Hand and headsets are used, the headset resembling a radio headphone.

ELECTRIC TIME SWITCH TURNS OFF AUTOMATICALLY

Capable of turning off the electric current at a time previously designated, a time switch can be installed as a part of the wiring system of home or office, and is found useful in operating electric-cooking utensils, irons, lamps, store-window, parking and garage lights, as well as cellar and porch lights. The switch is turned on with a toggle which sets the dial for the time the current is to remain on. The toggle is thrown when the operator is ready to disconnect the current which is then cut off automatically when the time reading on the dial expires. A small lever disconnects the time relay so the switch can be used like any other, and the relay can be set to operate in any period from a few seconds to several hours.

WIRE WEB SUPPORTS TREES WITHOUT HURTING LIMBS

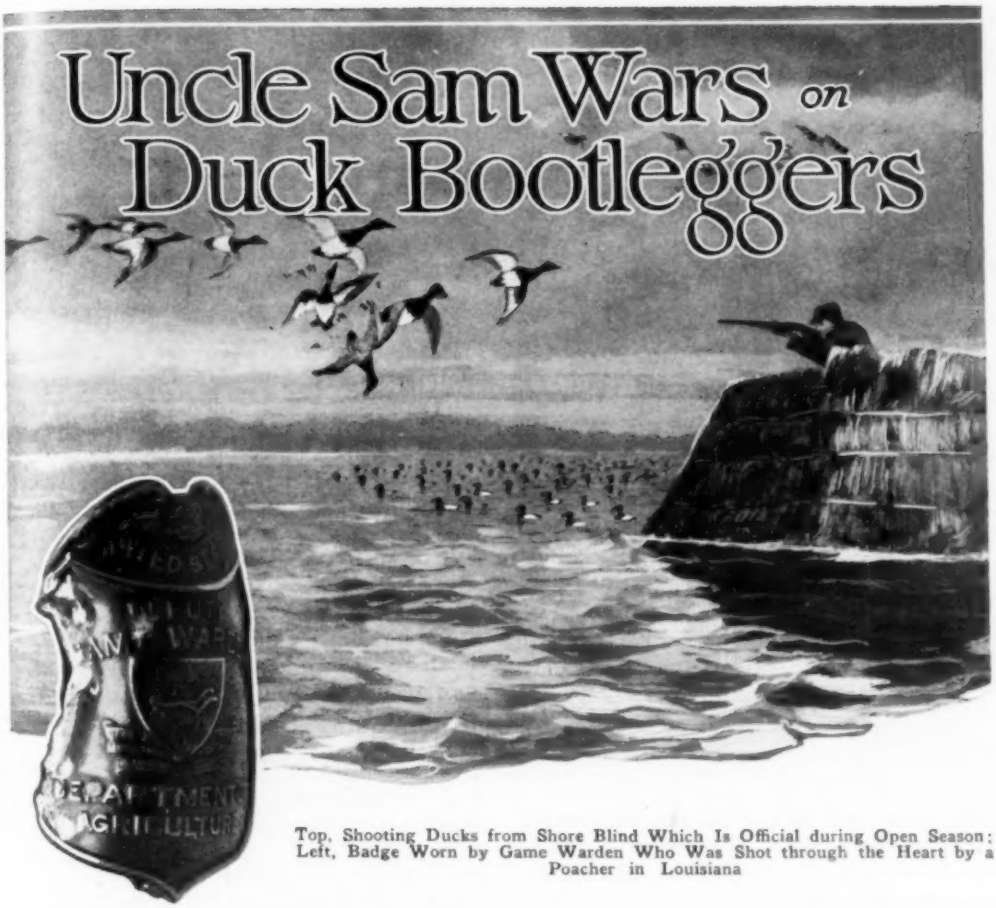
Easily and quickly adjusted, a circle-wire system has been devised for supporting the limbs of fruit and other trees to prevent breakage and insure better growth. The wire somewhat resembles a spiderweb, the various branches being held up from a central point. Protecting collars are slipped about the limbs.



HOW TO PRESERVE RED COLOR IN CANNED STRAWBERRIES

In making strawberry preserves, the loss of the rich red color of the fresh fruit is due to an oxidation process, oxygen combining with the red pigment of the berries. To prevent this to a great extent, the stemmed and washed berries are mixed with the sugar and allowed to stand overnight at room temperature before being cooked. Under these conditions, the natural respiration process of the fruit exhausts the oxygen of the tissues and materially reduces oxidation during cooking. Strawberries, both fresh and preserved, are a good source of vitamin C.

Uncle Sam Wars on Duck Bootleggers



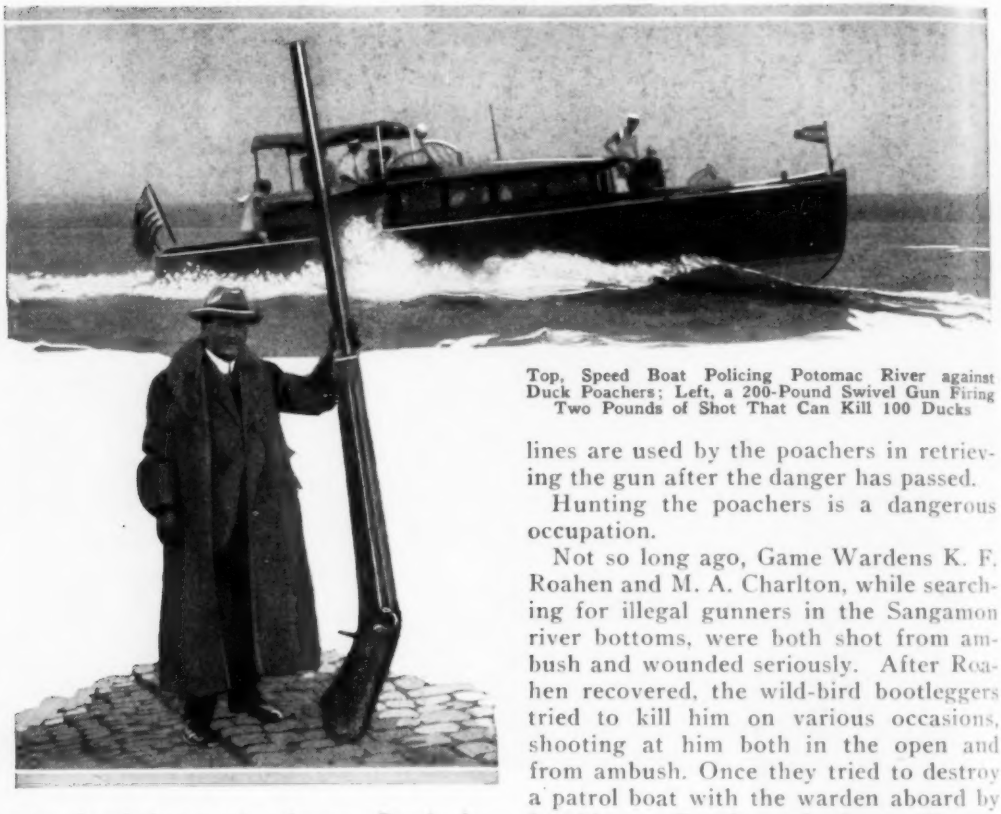
Top, Shooting Ducks from Shore Blind Which Is Official during Open Season; Left, Badge Worn by Game Warden Who Was Shot through the Heart by a Poacher in Louisiana

DUCKS by the million are being killed each year by organized poachers—the newest gangster racket—along the Illinois river, down the Mississippi, on the Gulf coast from New Orleans to Texas, on the Susquehanna flats of the Chesapeake bay country, in the latitude of Virginia's Back bay near Norfolk, at Currituck sound and along the Potomac river.

If you are "in the know," you can purchase mallards at approximately $5 a pair almost any month in the year. These illegal waterfowl are kept in cold storage indefinitely. You can buy the finest canvasbacks almost in the shadow of the capitol at Washington. The "ante" is higher for these eastern game birds, the price frequently soaring to $10 the pair.

These ducks are shot from brush shore blinds, from sink boxes, from motorboats and from other strategic points of waterfowl concentration. The illegitimate hunting as an organized business goes on night and day. Five-shot automatic guns are the predominating weapons used, while many guns are equipped with special extensions which screw onto the end of the automatic magazine, increasing the shots fired from one loading to nine. Under favorable conditions, a seasoned poacher will bag from twenty to fifty ducks from a single loading with one of these slaughter guns. Along the Potomac river and on the Chesapeake bay and Back bay of Virginia shooting grounds, the English punt or swivel gun, the deadliest weapon known for waterfowl bagging, is used in the poaching, which is practiced almost exclusively on moonlight nights.

The punt guns are really midget cannons, being from ten to thirteen feet long and weighing from 150 to 200 pounds. Each gun is of the muzzle-loading type and shoots one pound of powder and two



Top, Speed Boat Policing Potomac River against Duck Poachers; Left, a 200-Pound Swivel Gun Firing Two Pounds of Shot That Can Kill 100 Ducks

pounds of shot to the charge. Ready for river or bay service, one of these guns is usually mounted in a power boat with a special recoil block.

A waterfowl calamity results when one of these guns is fired at comparatively short range into a rifted flock of ducks, the bag from a single discharge usually amounting to from thirty-five to 100 ducks. As many as 125 ducks have been killed or crippled by a single shot from one of these swivel guns. The crippled ducks are left to perish, for the poachers race to another section of the river as soon as they have fired the big gun once.

If game wardens intercept a suspicious boat during their night patrol, it is only rarely they find a punt gun on board, as such a firearm is always subject to immediate confiscation. It is the traditional custom among poachers to toss the gun into the river when its capture portends. Fishlines and spools are always attached to the big weapons. The gun sinks to the bottom while the floating spools mark its submerged position. These spools and lines are used by the poachers in retrieving the gun after the danger has passed.

Hunting the poachers is a dangerous occupation.

Not so long ago, Game Wardens K. F. Roahen and M. A. Charlton, while searching for illegal gunners in the Sangamon river bottoms, were both shot from ambush and wounded seriously. After Roahen recovered, the wild-bird bootleggers tried to kill him on various occasions, shooting at him both in the open and from ambush. Once they tried to destroy a patrol boat with the warden aboard by bombing. Poachers fired on Deputy Game Warden J. J. McHugh near Browning, Ill., wounding him dangerously in the thigh. A little later, three poachers assaulted Game Warden B. G. Merrill near Hinsdale, Ill., robbing him of his pistol and badge and threatening to drown him in the drainage canal near by unless he left that country.

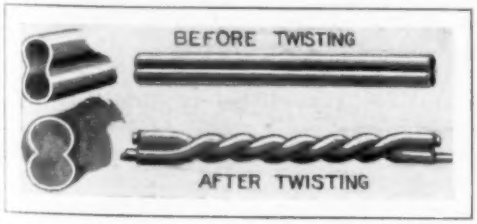
Poaching is one of the two most vital causes of the rapid disappearance of mature migratory birds, being only excelled by legalized hunting during the open season in the enormity of its annual kill. Many of the poachers, particularly those in the Illinois river district, use traps of wire as reinforcements of gunfire, into which they bait wild ducks, killing the waterfowl like poultry after capture. Both wooden and living decoys are used. The government reports a fourfold increase during the last decade in the number of hunters and fishermen. A census of the poachers is impossible but they have increased greatly, particularly since the organization of duck bootlegging.

AUTOMATIC CONTROL OF PLANE LEAVES THE PILOT IDLE

Airplanes can now be flown so accurately by instruments alone that the human pilot is virtually idle after having once set his course. The pilot of an army plane that was being steered automatically recently submitted to a radio interview, turning his ship over to the robot pilot and conversing with interviewers on the ship and others on the ground, questions and replies being heard by a radio audience. A magneto compass is responsible for the success of automatic steering. Heretofore the pilot has had to steer the ship himself, relying on his instruments or on visual observations around him. Now he simply sets his course and turns the plane over to the magneto compass. A further development is control of the steering equipment by radio beams which are already in use on airways. In combination with gyroscopic devices, the course of flight and the altitude of the plane may be controlled without the pilot's assistance. Altitude is determined by a sonic altimeter, the interval between an emitted note and its echo indicating height, the echo being received audibly or registered on a meter.

JOIN WIRES WITHOUT SOLDER IN METAL TUBE

Electrical and other wires can be joined without the use of heat or solder by means of a tube device recently introduced. The tube is made of semi-hard copper. One wire is inserted in each end, and then with the aid of pliers, it is twisted in opposite directions, causing it to form a solid connection that cannot be pulled apart. After the twisting, the joint is insulated. The tube was developed especially for use in explosive plants.



Double Tube in Which Electrical Wires Can Be Twisted Together without Heat or Solder

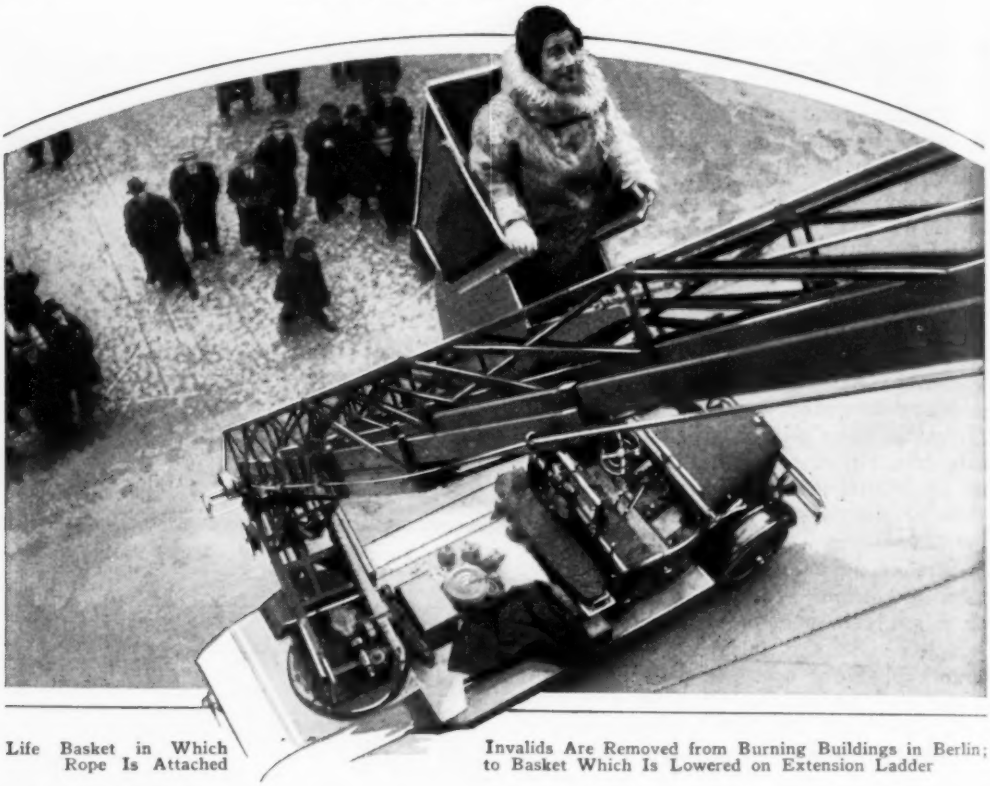
Sliding-Frame Electric Heater Which Slips under Hotbeds and Keeps the Soil and Plants Warm

ELECTRIC HEATER FOR HOTBED SPEEDS SEED GROWTH

Equipped with thermostat control, an electric heater for the hotbed automatically protects plants against sudden temperature drops. It operates on an alternating-current circuit, is easily installed and consumes comparatively little current, as the thermostat will turn the heat on or off as needed. The heater, in the form of a sliding frame, slips under the plant bed, where it warms the soil to the degree best suited for the development of the seeds and young plants.

CRIME INFORMATION BY RADIO FOR ALL OF EUROPE

At a recent congress of European police officials and criminologists, a plan was adopted to create an international radio clearing house for all information pertaining to crime and the detection of criminals. A Berlin station was selected as the central broadcasting agency and the system already has been adopted by Germany, Austria, Poland, Czechoslovakia, Switzerland and Hungary. The Berlin station will broadcast regularly crimes committed, descriptions of suspects, or, if they are known, complete information about criminals with pictures, fingerprints and Bertillon measurements supplied by telephotographic apparatus.



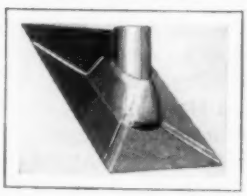
Life Basket in Which Rope Is Attached

Invalids Are Removed from Burning Buildings in Berlin; to Basket Which Is Lowered on Extension Ladder

LIFE BASKET FOR FIRE VICTIMS AIDS IN RESCUE WORK

To aid in transporting invalids from burning buildings, the Berlin fire department has been equipped with life baskets which slide down the frames of extension ladders. A patient in a burning hospital, for instance, is carried to a window, placed in the basket, and lowered to the ground, the descent down the ladder frame being governed by a rope. Such a method eliminates the necessity for carrying an invalid on a fireman's back.

SINGLE-PIECE ROOF FLASHING GIVES WATERTIGHT FIT



Eliminating the necessity for counter flashing or a hub to make a watertight joint, a one-piece roof flashing has been made for vent pipes. It is formed on a machine which shapes and draws the galvanized iron into the form of a cone, laying the seam and, in a simultaneous operation, punching the hole to fit the size of the pipe.

WHAT CAN YOU SEE THE BEST FROM "TAIL OF EYE?"

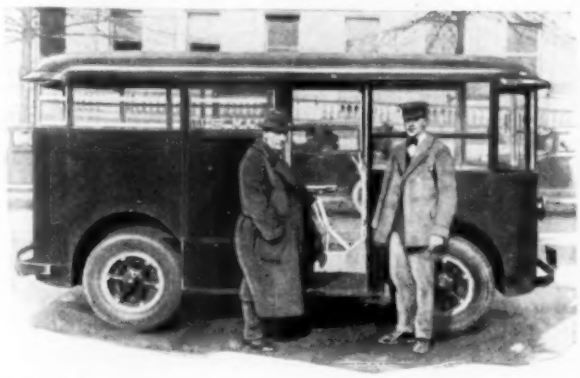
Quite often highway signs are placed along a road so the motorist obtains but a glimpse from the "tail of the eye" as he passes by with his attention fixed on the road ahead. Recent tests indicate that the shape of the sign is important, since some shapes are more easily identified than others without turning the head, and frequently the form of the marker serves as a symbol to convey some information without reading the lettering. It was found that the triangle is recognized from the tail of the eye more often than any other shape, with the square next. On the other hand, the triangle was recognized only when it was comparatively near the point on which vision was fixed. Other shapes were recognized through a wider field of vision.

DEPTH PRODUCED IN PICTURES BY UNUSUAL SCREENS

Three types of screens which produce the illusion of three-dimensional depth in pictures projected on them have been tested by Dr. Herbert Ives, of the Bell Telephone laboratories. Stereoscopic pictures which stand out in solid relief can be made either by the construction of the screen itself, or by the use of goggles by members of the audience. The goggle method has been tried with moving pictures, but is awkward. The screen method cannot be applied practically to the movies as yet. The depth arises when the eyes see slightly different views of the same scene, as they do when observing a real object. The illusion of depth can be obtained, however, by taking only one photograph with a large lens or concave mirror, and projecting it from the front on a screen made of horizontally ribbed cylinders. The picture also can be thrown from the back on a celluloid screen in which cylindrical grooves are cut, or be projected from the rear on a screen consisting of transparent cylindrical rods.

TRUCK TO SPEED UP THE MAILS LOOKS LIKE STREET CAR

Resembling a small street car, a mail truck of unusual design is being tested by the post office department as a means of speeding up the collection and distribution of the mails. The vehicle has wide doors on either side, like a dairy delivery truck, and is built close to the ground to permit ready entrance and exit.



© U. & U.

Mail Truck with Low Body and Doors on Each Side; the Unusual Vehicle Is Expected to Speed Up Collections

© Planet News, Ltd.

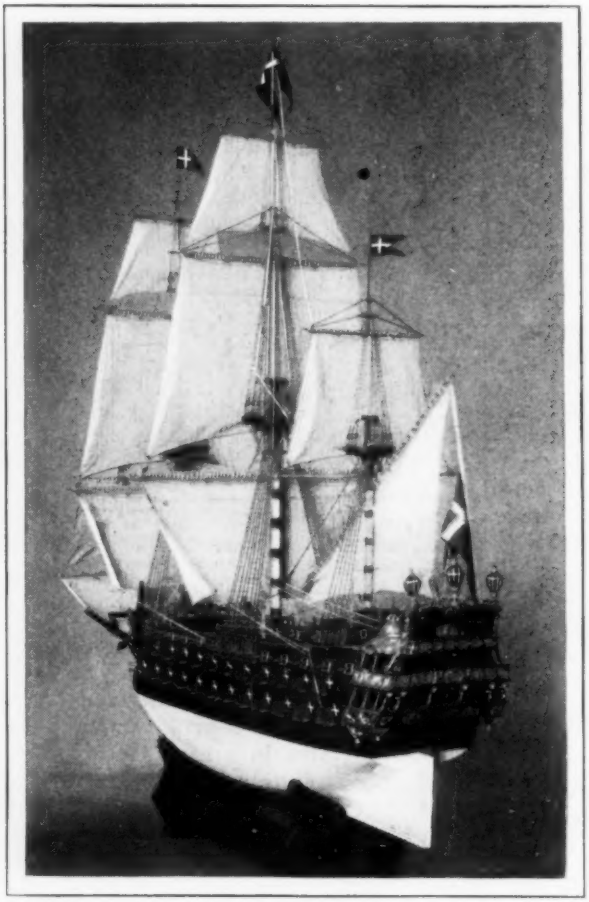
Movable Traffic Tower, Mounted on Wheels, Which Can Be Placed Wherever Congestion Demands

TRAFFIC TOWER ON WHEELS FOR CONGESTED POINTS

Portable traffic towers, mounted on rollers, are being tested in England as a means of solving the problem faced in controlling traffic in areas that are congested only at certain periods of the day. These towers, shaped like pyramids and painted with black and white diagonal lines, can be placed at any point in a street. At night they are illuminated, red and white lights flashing alternately.

CANYON NATIONAL MONUMENT

One of the most noted of the dwelling sites of early man on this continent, set in a deep canyon of great scenic grandeur, has been made a national monument by act of Congress. This is the Canyon de Chelly in New Mexico at the bottom of which are the ruins of Indian pueblos of an unknown age. To protect these ruins, until the region becomes more accessible, the area was given national-monument status, which means that it has been classed as containing natural features of the first order, although, at present, it is not considered of such importance as to merit inclusion among the national parks.



Ship Model Built from the Original Plans for the First Three-Decker Battleship of the Danish Navy

MODEL OF THREE-DECKER SHIP HISTORICALLY ACCURATE

One of the finest ship models extant in America, experts declare, is that of the "Christianus Quintus," originally planned as the first three-decker in the Danish navy. The model was built for the Massachusetts Institute of Technology by a Copenhagen model maker. The plans for the vessel, which was never actually built, were drawn at the close of the seventeenth century, still are in existence, and thus made possible a rare historical accuracy. It was designed when the increasing importance of guns in naval warfare forced ships to provide for from ninety to 110 cannon without any material increase in length. The three-decker proved a solution, and plans for the boat were submitted to the king for approval in 1697. Meanwhile it was rumored that Sweden was at work on an even larger vessel, and modification and enlargement of the proposed Danish ship finally resulted in the "Fredericus Quartus," so named for the successor to Christian V, who in the meantime had died. For several years it was the largest boat afloat, with a length of 190 feet and a displacement of 3,500 tons. Because they provided a fine target for the enemy, the white crosses on the gun ports later were abandoned. Inboard, the ship was painted red so blood would not be too visible in action. All carved parts were gilded, as many as 18,000 pieces of gold leaf having been used in ornamenting some of these fighting vessels.

MAN'S ENERGY IS WORTH ONE CENT AN HOUR

Man's energy, if applied to generating electricity, is worth about one cent an hour, but the cost per horsepower-hour generated by a man would be about $4 at current wages. A dynamometer about the size of a kitchen cabinet has been made by a University of Minnesota professor to measure the energy that man can develop and compare it with the power of motors, gasoline engines, water wheels, horses and windmills. The machine has two cranks. Turning one, a man is able to determine his physical "man-power" as indicated on a dial. The second crank is attached to a dynamo, and when it is turned sixty revolutions per minute, a voltmeter registers 110 volts. The man at the crank is then generating ninety-three and one-quarter watts, equal to one-eighth horsepower or one man-power. If the crank is turned at this speed for an hour, the man would generate electricity worth about one cent. Energy equal to a horsepower-hour from wind or waterpower would cost about one cent, from oxen or horses about fifteen cents and from steam about ten cents, it was estimated.

TORCH OPENS IRRIGATION DITCH CLOGGED BY WEEDS

Clearing irrigation ditches clogged by weeds which retard the water flow is accomplished by a California rancher through the use of a large and powerful torch. A long hose fitted with a burner nozzle is connected to a drum of low-grade distillate which has a pressure pump attachment. In operation, the apparatus burns all vegetation in the ditches down to the ground and destroys the roots. The torch was used originally to combat army worms which invaded cotton fields, and its use as a ditch cleaner was discovered quite by accident.

ONE-MAN ROAD ROLLER DRIVEN BY GASOLINE MOTOR

Offering the advantages of a hand roller, which it resembles, a large road roller, with a five-foot drum weighing nearly a ton and a half, is propelled by a gasoline motor inside the drum, and is operated easily by one man at a speed greater than those requiring the services of three or four men. The one-man roller can climb steep grades, proceed forward or backward and will cover 1,200 square yards of surface in eight hours.

Heavy Road Roller Easily Operated by One Man; It Is Driven by a Motor inside Drum

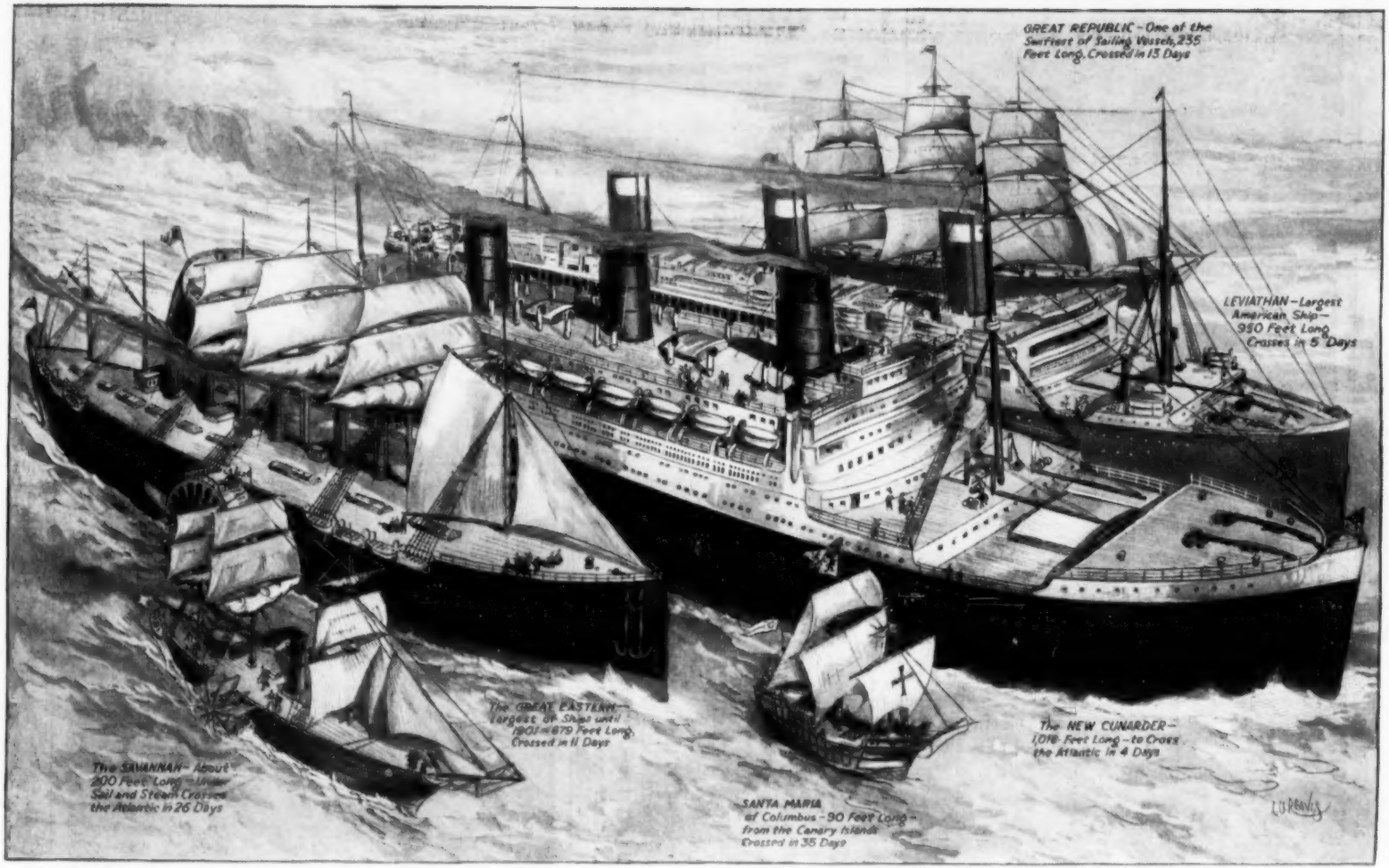
Violin Built on Edge and Shaped Like a Human Ear to Improve the Tone

VIOLIN SHAPED LIKE MAN'S EAR HAS IMPROVED TONE

In an effort to improve the tone quality of the violin without detracting from resonance or volume, a German musician and inventor has made an instrument bearing a striking resemblance to a human ear, which produces sounds of great sweetness and purity. This violin has virtually been built on edge, the sounding surfaces being vertical to the bow. These surfaces, therefore, do not need to be curved to make room for the bow and this, apparently, has increased the resonance of the instrument.

MOORING MASTS IN THE ARCTIC FOR POLAR AIRLINE

Two parties of scientists and mechanics have been sent to the Arctic to establish the two base stations farthest north for the proposed Zeppelin polar airline, planned to run from Berlin and London over the top of the world, down to Alaska and south to San Francisco. Four stations in all are to be built in the far north, each having a mooring mast, fuel deposits, food stores and boats. An experimental flight by way of the pole is planned for this summer. Such a route by airline eliminates the present twelve days run on the Trans-Siberian railroad, followed by a steamship trip across the Pacific.


GREAT REPUBLIC - One of the Swiftest of Sailing Vessels, 235 Feet Long, Crossed in 13 Days
LEVIATHAN - Largest American Ship - 950 Feet Long Crosses in 5 Days
The SAVANNAH - About 200 Feet Long - Under Sail and Steam Crossed the Atlantic in 26 Days
The GREAT EASTERN - Largest of Ships until 1901 - 679 Feet Long Crossed in 11 Days
SANTA MARIA of Columbus - 90 Feet Long - from the Canary Islands Crossed in 35 Days
The NEW CUNARDER - 1,019 Feet Long - to Cross the Atlantic in 4 Days

The Evolution of the Transatlantic Liner from Christopher Columbus' Tiny "Santa Maria" to the New Cunarder Which Is to Span the Ocean in Four Days, Compared with the Five Days Required by the "Leviathan"; the Larger the Boat, the Narrower the Ocean, When Computed on the Basis of Time Rather Than Distance

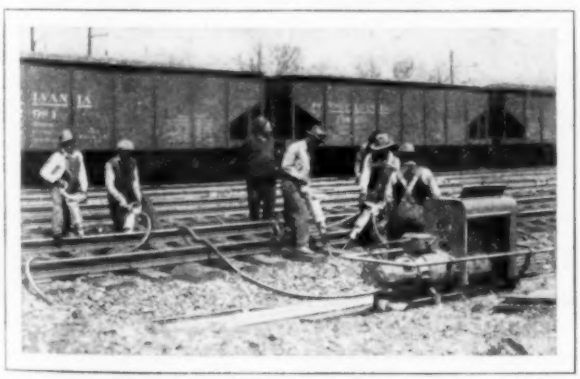
The Evolution of the Transatlantic Liner from Christopher Columbus' Tiny "Santa Maria" to the New Cunarder Which Is to Span the Ocean in Four Days, Compared with the Five Days Required by the "Leviathan"; the Larger the Boat, the Narrower the Ocean, When Computed on the Basis of Time Rather Than Distance

COAL FORMED BY PLANT DECAY ON FLOOR OF FOREST

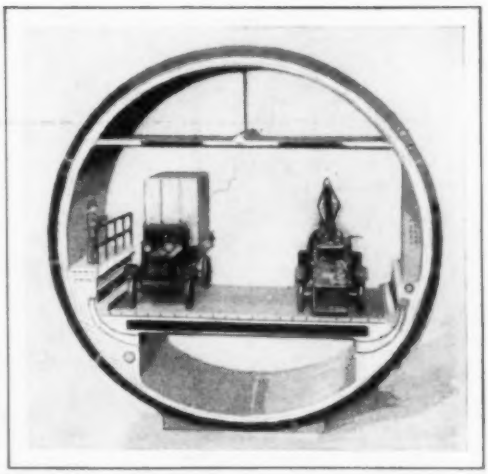
Coal was not formed from plant remains washed into great shallow lakes, as has been held previously, but was made by the steady fall of leaves and other plant waste on the forest floor in the vast, ill-drained swamps of the coal ages. This is the theory of Dr. David White, of the geological survey, who, in many tests, has shown the roots of the coal-age trees imbedded in the clay strata underlying the coal. He believes the laminated, or sheetlike, structure indicates a probable seasonal deposition. It is now generally recognized that coal could have been, and probably was, formed in a temperate rather than a tropical climate with recurring wet and dry periods or summer and winter weather. The occurrence of "mineral charcoal" on top of coal layers does not necessarily indicate that coal swamps were burned over at intervals, in Doctor White's opinion.

RAILROAD-TIE TAMPING OUTFIT RUN BY ELECTRIC MOTOR

Tamping railroad ties, a back-breaking job detested by every section gang, now is being done mechanically. Electric tie-tamping outfits, operated by small portable power plants, are being added to the maintenance equipment of many railroads. The tampers are simple electromagnetic hammers. A free-moving piston, reciprocated by two magnets, strikes a heavy blow on the shank of the tamping bar and the operator need only guide the tool.



Electric Tie Tamper Operated by a Portable Power Plant; Several Tampers Are Run from One Power Source



Model Section of Vehicular Tunnel Planned for Boston; Note Elevated Sidewalk for Attendants

VEHICULAR TUNNEL IN BOSTON TO COST SIXTEEN MILLION

Designed after the Holland tube in New York and the Fleetway tunnel in Detroit, a passage for vehicles planned for Boston is to cost $16,000,000. The model section in the accompanying illustration shows the tunnel's width and height and the space at top, sides and bottoms for ventilation. An elevated sidewalk provides a passage for attendants.

NEW VEGETABLES ARE STUDIED TO DETERMINE FOOD VALUE

Educating the public to the food value of the host of new vegetables continually being brought from all over the world to enrich the American diet is a task of the bureau of home economics. The chemical content of each dietary newcomer is analyzed and its nutritive value accurately computed. Chinese cabbage, broccoli, dasheens and many other common vegetables of today were almost unknown in this country a few years ago. Chinese cabbage, for instance, has been found to have a fuel value of about seventy-five calories per pound. It is about ninety-five per cent water and the outer leaves are waste. The rest is made up of nitrogen, fat, ash and starch.

Dynamite *in the*

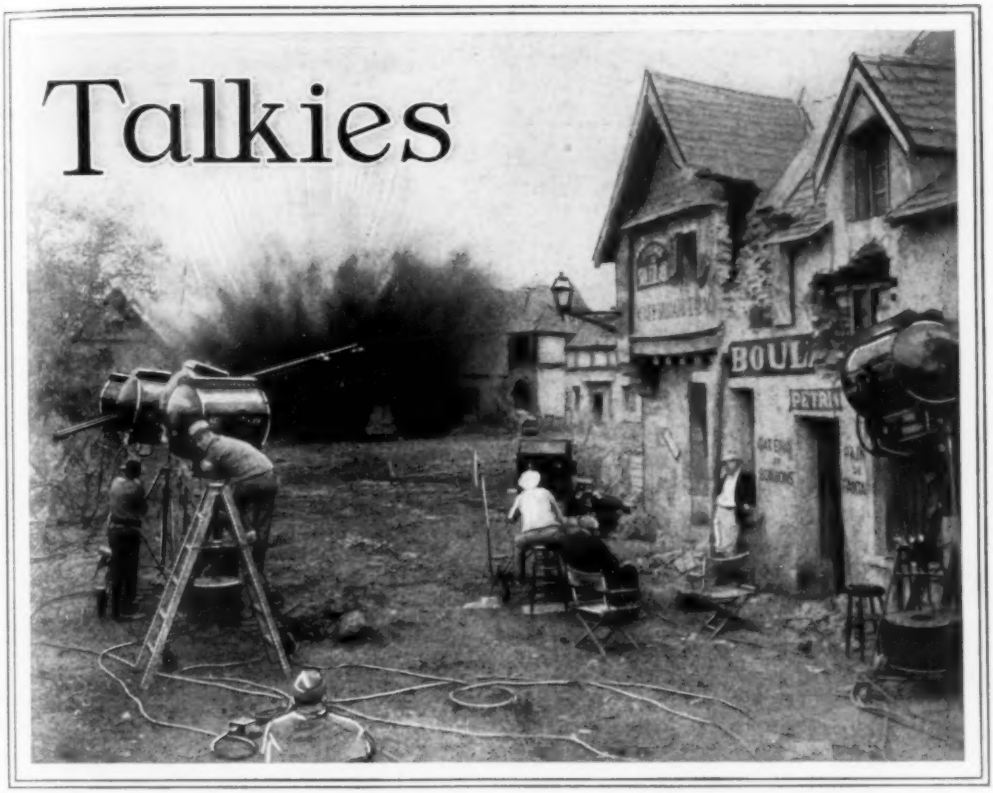
Top, Dynamiting Side of Cliff for Movies; Below, Powder Expert at His Switchboard, Ready to Set Off a Blast

THE EXPLOSIVE expert at a movie studio is a very busy man. Many keep one on salary at all times, while others call in a "blow-up" man only at such times as there is a definite need of him.

One of the most important uses of explosives is for the creation of smoke screens. Fog is invariably produced by the use of smoke pits, often in broad daylight. While many of the spectacular effects in the movies have been made in miniature, many others are made on life-size sets. Where a drifting-fog effect is desired, for a setting laid in London perhaps, three or four of the large pots are used, set directly in front of a slow-moving airplane propeller, or "wind machine." The current of air tends to drift the smoke, or fog as it will show up on the screen, before the camera lens. In miniature sets, smoke may be used to fill valleys or hollows in the terrain and add realism and distance to the setting. Yellow smoke is invariably used, inasmuch as it will photograph white.

Another important use of powder for the creation of smoke screens is for the

Talkies



Off-Stage View with the Camera and Technical Staff in Action during a Dynamiting Scene; Note Man to Right of Camera with Coat over Head as Protection from Flying Debris

obliterating of undesirable backgrounds. Lightning effects also may be obtained in a variety of ways. Studios prosperous enough to afford one, get their lightning by the use of a torch, which resembles nothing so much as an overgrown photographers' flashpan. Powdered aluminum and magnesium, which become very inflammable if ground sufficiently fine and burn with an instantaneous and intense light, are used in it. Lightning obtained with these torches is very realistic. They have been used for lighting in rare instances where very intense illumination is desired, but for very short periods of time, on locations where it is impossible to make a set with large electric lights.

Forest fires, so lifelike that they fool even experienced rangers, have been obtained many times in the studio lots by the judicious use of smoke powder and crude oil. Trees are set up along a line, sufficiently thick so that they will show up well in the camera. A trench is dug, shallow and wide, behind the trees. This is filled with crude oil and tar, and smoke powder is spread on top of the mixture. The trench is camouflaged, and the mixture is ignited. The oil burns with spurts of flame, which show up through the dense clouds of smoke resulting from the powder, giving a forest fire of unbelievable realism.

The use of explosives in movie battles, however, has brought the explosive expert to his present place of importance. The preparation of a battle set for occupation by the movie army requires almost as much care as the preparation for a major offensive in actual warfare. Charges of explosives are placed in designated spots, and connected electrically to a master switchboard, from which they are detonated at the desired moment. These switchboards are masterpieces of electrical design. Probably the most intricate of them all was used by the Fox studios in the filming of "What Price Glory" a year or so ago. This board contained over 6,000 separate contacts, and

Top, Filming an Explosion for a War Picture; Below, Powder Expert and Some of His Equipment

from it explosions, smoke screens, cannon fire, barrages and the movement of troops through the scenery were controlled.

In the filming of "Hell's Angels," there occurred an instance which vividly depicts the effect of accurate timing and placing of explosive shots. The scene was a partial miniature, wherein a huge Gotha bomber, in reality a miniature of the actual plane, was to fly over the battlefield and go suddenly into a nosedive to destruction. The plane was hung on wires and controlled so that it would dive at the crucial moment into the spot upon which the camera was focused. Charges were placed in the wings of the bomber which would go off when the plane hit the ground and completely destroy the model. However, battle fire was to take place in the background. Cannons, varying in size as they were placed farther and farther from the camera, were fired during the scene. A group of soldiers also were to run through the bombardment toward the fallen plane. Lines were marked off on the ground, a good many hundred feet in front of the camera but out of sight, showing the soldiers just where to run.

The filming of Universal's "All Quiet on the Western Front" brought many problems to the fore which had to be solved before a successful picture could be made. Coming as it did as the first

pretentious war picture to be made entirely in sound, it presented many problems. Machine-gun firing, which was used so effectively in that picture, was obtained by placing thousands of detonators in the earthworks above the trenches just under the top of the ground. Connected electrically to a pianolike switchboard, they were set off in groups. Tiny puffs of dirt and smoke showed up with each explosion and gave the exact effect of machine-gun or small-arms fire.

The craters throughout No Man's Land, showing up after the "big-gun" explosion, were prepared in advance. Varying of course with the size of the crater desired, dynamite in sticks and magnesium powder were buried in the ground at the designated spots. The dynamite provided the necessary force to dig the crater, while the magnesium powder gave the required flash to the explosion. Shells bursting overhead were simulated by stringing small bombs, made of black powder and flash powder, on invisible wires and exploding them electrically at the desired moment.

The charge of troops across the battlefields, through heavy barrage, is executed in such a manner that no one is injured. Powder is placed in a pan and buried slightly under sawdust and chunks of cork, none of which is packed tightly. This mixture, exploding, throws debris far into the air and gives the impression of dirt and rock flying through the air.

ELECTRIC FOLDING BED RAISED OR LOWERED BY MOTOR

Electrically operated wall beds that are raised or lowered at the touch of a button, offer an additional convenience in homes or apartments where economy of space is important. The beds are furnished in standard sizes and are without rollers or casters. The small motor that operates the bed is plugged into a wall outlet and needs no attention. At any time during the raising or lowering, the bed can be stopped by merely turning off the motor. The mechanism, which also may be made to open the doors in the closet where the bed stands, is virtually noiseless and has an automatic cut-out that disconnects the motor when the bed touches the floor.

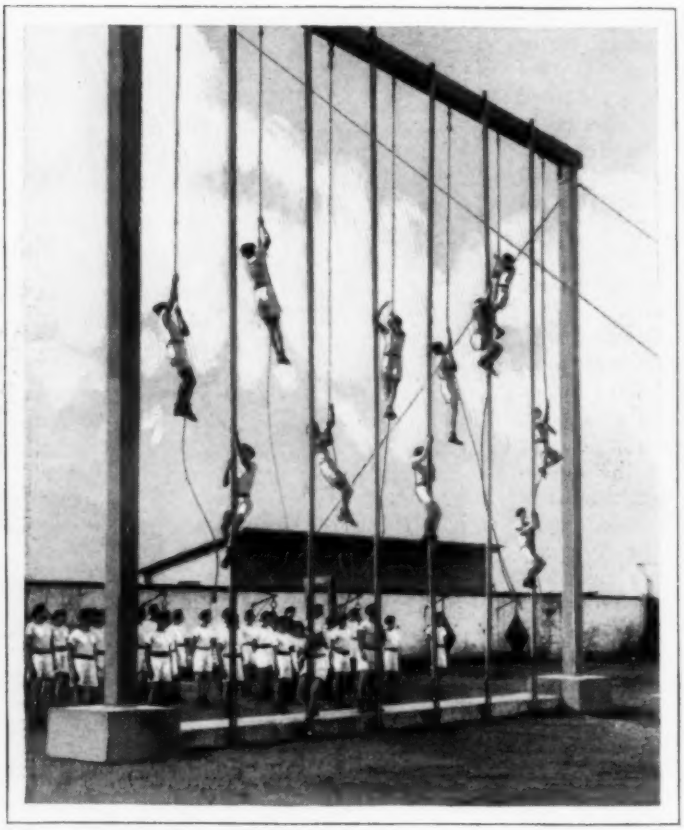
Preparing Design from Seaweed for Printing Paper, and, Placing Paper on Design

PAPER PRINTED OFF SEAWEED FOR BOOK BINDINGS

Paper-marbling, or printing paper from seaweed, is an ancient art still practiced in its original form in making decorative designs for binding valuable books. A size is prepared from dried seaweed and inks in various colors are sprinkled on this and spread into a design with a small steel rake. The paper is placed on top, and the print transferred to it.

GLASS TUBE OVER CUCUMBER MAKES IT GROW STRAIGHT

Cucumbers can be forced to grow straight despite any tendencies toward crookedness by the use of individual glass cylinders, open at both ends. A cylinder is slipped over each cucumber when it appears on the vine, constituting an individual greenhouse for each future pickle, and at the same time guiding the growing vegetable along a straight path.



Cadets Training for the Italian Navy Climb Ropes to Increase Their Agility before Tackling the Masts of a Vessel

NAVAL STUDENTS CLIMB ROPES TO ACQUIRE AGILITY

Cadets training for entrance into the Italian navy take a complete and rigorous course in gymnastics on land before they begin climbing the masts of any vessel. As a preparatory feat for shinning up a mast, the student sailors go through a series of rope-climbing exercises in an open-air gymnasium. The ropes are attached to a lofty framework, and the students are required to make the ascent in approved manner and in a limited time.

FILLETS SKINNED BY MACHINE

Skinning fillets, a tedious process even with experts, now can be done by a machine operated by a person without experience in skinning. It is of simple, inexpensive construction, and plans are available for making it at home.

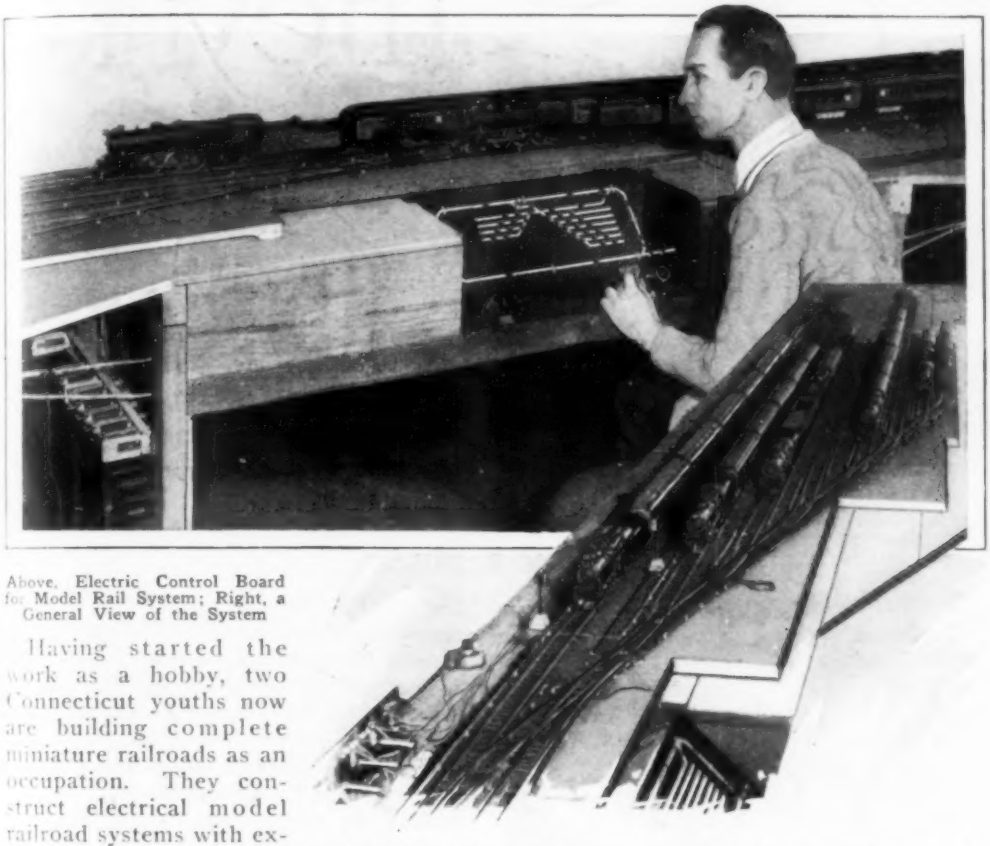
COLORS IN SHOPS RELIEVE EYE STRAIN

Eye strain and fatigue of workers in factories is being relieved by painting the machinery in gay colors. One eastern shoe factory has used delicately tinted paints not only on its machinery, but on benches, doors, walls and furniture, after extensive tests indicated that color and light in the plant had a direct effect on the health and comfort of the employes and on the amount of work they were able to turn out. The experiment started when one workman complained of eye strain and painted the machine on which he worked a bluish-green. It was found the color broke up the shadows, softened the light and relieved the eye fatigue. Acting on this experiment, the owners worked out a color scheme for the entire plant, some machines being tinted in orange, others in orchid-purple and still others in green. Tables, benches, steam pipes and even typewriters in the accounting department were given bright hues as the work progressed.

BRUSH TO CLEAN TYPEWRITER HAS LIQUID IN HANDLE

Soiling of hands and fingers in cleaning typewriter keys is prevented with a fountain brush containing a supply of cleaning fluid in the glass bottle which serves as a handle. The flow of this liquid is started by unscrewing the top a turn or two.

MODEL RAIL SYSTEM TEACHES TRAIN OPERATION



Above, Electric Control Board for Model Rail System; Right, a General View of the System

Having started the work as a hobby, two Connecticut youths now are building complete miniature railroads as an occupation. They construct electrical model railroad systems with express, local accommodation, freight and mail trains in operation in the same manner as on any real railroad. The scope of their business varies. They supply parts to amateur builders, furnish model engines and cars or complete systems to be used by railroads for exhibition purposes or for instructing trainmen. The control system of the model lines is fool-proof.

SEVEN-THOUSAND-MILE PHONE FROM SHIP TO SHORE

Covering a distance of over 7,000 miles, the longest radio-telephone conversation yet recorded between ship and shore was carried on recently from the "Belgenland," located between Shanghai and Hongkong, to London. Heretofore ship to shore telephone service has been confined to the Atlantic ocean. Another long-distance telephone conversation was reported by A. J. Smith, Racine, Wis., business man, who was traveling in Australia on the day trans-oceanic radio-telephone service was inaugurated between that country and the United States. He put through one of the first calls, talking with his family.

U. S. ACTS TO SAVE HALIBUT FISHERIES OF NORTHWEST

Under the recent halibut treaty, a move has been started to conserve the great halibut fisheries of the Pacific northwest, valued at about $7,000,000 annually. An international commission is to attempt to conserve the fishing grounds without interfering seriously with commercial fishing. About sixty-five per cent of the world halibut catch comes from this region, and among remedies being considered are closure of areas inhabited by immature fishes, prohibition of destructive gear, and the lengthening of the general closure period by two weeks.

They're

Twelve Hoofs All in the Air during a Driving Neck-and-Neck Finish to a Hard-Fought Race; Note the Positions of the Jockeys on the Necks of Their Mounts to Push Them Forward

By R. B. JAMES

TEN horses, their coats sleek in the afternoon sun, line up across the track. Marshall Cassidy, starter of 15,000 races, leans against the rail of his stand, ready to press together an electrical contact that will lift the rubber tape and ring a gong to send the field away.

Three assistant starters move rapidly from horse to horse, backing this one up, pulling another forward. All must face the tape, be fairly quiet and ready, before the barrier rises to open the way to possible fame and fortune.

Suddenly the tape rattles up the slide, the bell breaks the calm that had settled on the track, jockeys whoop and the field plunges forward. Great knots stand out as the ponies' hindlegs drive them forward, all making for the rail.

Near the grandstand, across the track from the judges' stand at the finish, a judge trains his binoculars on the racing horses. A microphone, fixed to a pair of shoulder hooks, fronts his mouth.

"They're off!" he exclaims. The crowd leaps to its feet.

Twenty-five loud speakers, scattered through the grandstand, betting ring and clubhouse at Agua Caliente, call laggards to the rail.

As the horses lunge forward from the starting stalls and emerge from the chute, the leading horse breaks an invisible thread stretched across the track. Simultaneously, in a tiny room beneath the judges' stand, two electrical impulses are recorded on a revolving drum.

On this modern track, horses no longer win by a nose. One may appear to the public to win by a nose, but, in fact, the leading horse starts the record on the revolving cylinder when he breaks the first string with his shoulders. When he touches the tiny brown thread, it stretches; this causes a break in the line of red ink pouring on the drum, but a hundredth of a second later the string parts and another indentation is recorded. And at that moment the race officially commences. Thus, the breaking of two strings fixed to electrical circuits at start and finish enables the judges to time races to one-hundredth of a second, twenty times faster than was possible with stop watches.

It's the same old thrill, though, to jockeys and public alike, as colors flash and hoofs thunder toward the finish line.

"They're rounding the first turn," boom the loud speakers. "'Lamkin' leading, 'Rapida' second, 'Forebec' third. On the back stretch, 'Lamkin' by two lengths. On the far turn, 'Lamkin' tiring. 'Forebec' making up ground and going to the front. 'Lamkin' tiring. 'Gotham' racing

Off !

well, moving into third place. Here they come! 'Forebec' wins."

Behind the passing flash of colors, the salute of jockeys as they bring their mounts past the judges' stand after the race, one finds a gigantic organization embracing large numbers of people and the best devices mechanics and science can provide to entertain the crowd and speed the races. Seven races compose the usual card for one day at many tracks, but 3,500 men often are necessary to run a racing plant and keep the horses in condition to face the barrier.

Skilled men conduct the betting, where betting is permitted; others record results; gallop horses; assist in starting; judge races and finishes; record jockeys, prices and winning numbers on boards that disappear underneath the ground between races; school yearlings and teach them the rudiments of racing; doctors watch over horses and jockeys; valets clean colors and shine boots. It's a giant undertaking, commencing with the pony's first birthday and continuing until it runs its last races and retires to the foal or the stud.

Cassidy alone has started races with a total purse value of $15,000,000. Many more millions were wagered on these contests of speed and stamina. And in looking down from his stand on the start of 15,000 races, he has developed a camera eye, focusing his attention on one horse and rider, yet seeing everything that takes place all along the line. Not a boy spurs

Above, a Colt Unseating Its Rider on Its First Trip to the Barrier; Below, Seventeen Closely Bunched Riders Rushing Their Horses Home during the Running of a Handicap Race

a yearling nor crowds too far forward that Cassidy does not see.

"How," I asked, as I stood in the stand at the start of a seven-furlong race of three-year-olds, looking over his shoulder as a bunch of bad actors killed valuable time rearing and plunging, "do you train these temperamental beasts to maintain even a semblance of self-control under such exciting conditions?"

"The bad actors are disappearing from the American track," he replied. "They are bad generally for one of two reasons, heredity or faulty handling. Owners do not want the 'get' of those strains noted for bad acting and as a result only the fit in temperament are surviving. If we introduce the yearlings to the track with kindness and lead them through their primary exercises gradually as one would a child, most horses will develop into fairly dependable runners; not necessarily fast, you understand, for training cannot make a sprinter of a plug.

"Much of a horse's success depends on good riding. In schooling yearlings with the newer jockeys, I frequently take slow-motion pictures from the rear. Later I run these, then show a picture of Sande or Fator, two of the most perfect riders the world ever saw. By comparing them, youngsters can learn how they err at the start, in pulling up, riding a horse's neck or being slow in urging their mounts forward.

"Before yearlings face a barrier, however, we drill them much as a rookie soldier learns squads right and left. When the training starts they are galloped short distances to take off surplus fat. A rider breezes a yearling slowly,

Top, Starting Lock That Releases Rubber Barrier; Center, Stretching a Jockey's Boot; Below, a Colt Drinking Milk from a Bottle

first one-eighth of a mile, then one-quarter mile. After they are physically fit, the track starter takes over all the youngsters for their early education.

"When a bunch of yearlings comes to me we take all their markings, family history and other data. Up to this time the ponies have not been named. By the markings we can identify them. At the outset we start them in a series of parades, first walking singly in a circle past the starter's stand, then in twos, fours and eights. These are virtually military maneuvers which teach them to turn in company with other ponies.

Above, Starting a Race from Stalls; Below, Lined at the Barrier in Starting Stalls; the Tape Springs Up and Forward When Released

"Once they have learned to 'march,' we line up possibly forty ponies facing the starting stand, with the starter in the box. He remains very quiet and gradually raises his voice in conversation while assistants on the ground shake the ropes on the starting gate, shuffle their feet and finally shout at each other. This accustoms the yearlings to the excitement that usually accompanies a start in a race.

"Our next move calls for the ponies to line up about fifty feet from the starter. An assistant stands quietly at that distance in front of their faces. After a minute of quiet, he walks slowly toward them and along the line. After this the entire 'company front,' with jockeys in the saddle, walks ahead fifteen steps and stops. Then the jockeys and helpers back them up by voice commands and assistance on the bridles.

"Even yet the ponies have not faced a barrier. Nor are they ready. Possibly one-tenth, certainly no more, will back up without further instruction. This is accomplished simply and effectively, tapping them on the knee with short pieces of light string. Fortunately, once a pony learns to back at his rider's guidance, we never have to spend more time with this lesson.

"For two weeks we work daily with the yearling class, then we take them to the race track for lessons in breaking; that is, running together in a straight line on signal. We start them in groups of three or four, about one-eighth mile from the finish line, and let them breeze easily for that short distance. I stand near the

rail at the start and send them away by ringing a portable bell such as they will hear throughout their racing careers.

"During this time they are strengthening their muscles and learning to start and run in a straight line without crossing over in front of other ponies. After breaking groups of four, each group having come from a single owner, we divide the youngsters into groups of eight, no two of which have run together on a ranch or training field, and give them practice in both running and standing starts.

"Now we're ready to introduce the little fellows to the chutes. We line up a bunch at the barrier, an elastic webbing, and let them rub their noses along it, bite up, rub it behind their ears until they become thoroughly familiar with it and have no fear of it springing forward in their faces.

"Our next move depends on whether we're using starting stalls or not. At fully nine-tenths of American tracks starting stalls are available. In schooling with stalls, the barrier is raised and the colts brought into position. After we break them two or three times with the bell, the barrier is pulled down into place. Then the yearlings are moved up until their heads are under and in front of the barrier. They hear the bell and the snap, but cannot see the line spring up; and they go away unfrightened. Now we're ready for a conventional start. If we have been careful in our work, nearly every pony will be ready to race and will shy very little at the barrier.

"The race horse is one of the finest ma-

Jockey Holding Complete Equipment for Saddling a Race Horse, and Disappearing Board on Hydraulic Ram, Where Winners' Numbers Are Posted

chines built by nature; he is his owner's only tool. But to take proper care of him, the owner must do more than oil and grease him and keep him in general repair. A race horse reacts directly as he is treated. Like a human, sudden changes upset him. From the first day a colt runs

loose in a field, every change in his method of living is brought about gradually.

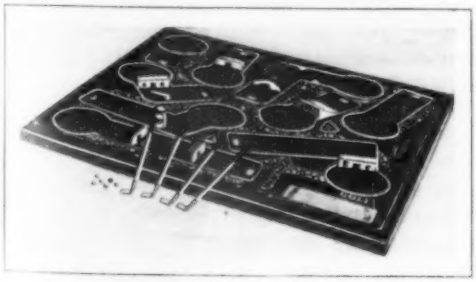
"No horse is better than his feet. Trainers watch first their feet, next their diets. I have seen trainers run their horses on sandy river beds to develop strength; some trainers have found salt water of the Pacific ocean an excellent tonic and they exercise their horses on the beach and walk them in the surf. They're the finest athletes in the world and careful trainers take every precaution to keep their horses fit for racing."

ELECTRIC LOCK FOR GAS TANK FOILS AUTO THIEVES

To thwart automobile thieves, an electrically operated gasoline lock keeps the fuel from flowing through the carburetor when a secret switch is thrown by either the hand or foot, according to its location. In the event of a holdup, the motorist cuts this switch after which the car can proceed only a short distance. Control of the gas flow is governed by a steel ball and small electromagnet within the feed pipe. Turning on the switch causes the electromagnet to attract the steel ball. When the switch is cut, the ball drops and stops the gasoline flow.

GOLF COURSE FOR CARD TABLE CONTAINS NINE HOLES

Miniature golf has shrunk to card-table size. A complete nine-hole course is now laid out on a piece of heavy metal, two feet square. The fairways are of a composition material which makes them look and play like real grass, and hazards are made of wood in colors. The metal sheet is mounted in a wooden frame, and the game is played with tiny putters and balls.



Nine-Hole Golf Course on a Metal Base That Can Be Accommodated on a Card Table

Electrically Operated Car on a Track Which Saves Climbing Steps to This California Home

HOMEMADE ELEVATOR SAVES WALKING LONG STAIRS

One Los Angeles man whose home is on a bluff tired of walking a long flight of steps from the street to the house, and constructed an electrically operated car to carry him and his family back and forth. The car, large enough to hold two persons, runs on a track made of angle iron fastened to wood timbers, and is operated by a one-third-horsepower motor to which is attached a worm gear for winding up the cable. The track is ninety feet long and rises at an angle of about forty-five degrees. The car, with ten-inch wheels, has a slanting floor with a quarter-inch cable attached to the rear end, and from this contact is made when a switch is pressed. Two dry cells under the house furnish current to start the motor and these are grounded to the rails, so that, when the switch is pressed on the car, the circuit is completed. The system operates from either end of the track by pulling a wire to reverse the motor.

¶Color blindness affects about four per cent of males and four-tenths of one per cent of females.

Luxurious Interior of a Club-Model Plane for the Busy Executive; Walls Are Finished in Walnut and Tapestry and Floor Is Carpeted

LUXURIOUS CLUB-MODEL PLANE BUILT FOR EXECUTIVE

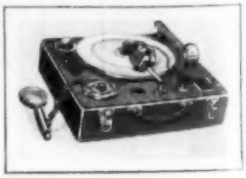
One of the most modern and luxurious forms of transportation yet offered for the business man who wants to eat, sleep, work or be entertained while traveling by air is a tri-motored club-model airplane with a cabin outfitted on a scale like that of the most expensive yacht. Externally and from a mechanical standpoint, the ship resembles those used by airline operators, but the interior has been developed entirely to add luxury and comfort to air travel. Behind the pilot's compartment is a small room fitted with writing desk, chair, clothes lockers and luggage compartments. A place also is provided for a typewriter and magazine rack. Behind this is the main cabin, with side walls below the window ledge finished in stump-walnut grain and headlining materials of tapestry above. Four upholstered chairs are grouped about a removable table, and back of them is a reclining lounge chair with a drop table in front of it and a built-in cabinet near by. The floors are carpeted, and to the left of the main cabin, is an auxiliary room containing a cabinet for toilet articles, a folding mirror and washbasin, and other accessories. Behind this is a commissary room with refrigerator, sink, china cabinet and space for thermos bottles and other equipment. Ash trays, vanity cases, glass holders and reading lights add to the conveniences and a radio receiver is available.

CELLULOID THAT IS FIREPROOF HAS MANY USES

Celluloid which is fireproof now is available, and this quality has greatly extended the usefulness of this material. It is already being employed in cosmetic jar tops, lamp shades, thermometers and automobile hardware, and the extent of its non-inflammability is shown by the fact that it has been approved as a material for making night-flying lights on airplanes, and is used as a fire-retarding window in the petroleum-refining industry. Its future popularity is based on the fact that it can be machined. It can be blanked, drilled, sawed or even turned in a lathe, thus offering craftsmen an opportunity to make objects simulating semi-precious materials. It is primarily a molding material, however.

A PHONOGRAPH-RECORD MAKER ATTACHES TO RADIO

Phonograph records can be made instantly in the home or office by an attachment to any electric radio receiver, thereby forming a combination for playing the records after they are finished. The instrument can be used to make records direct from a radio broadcast, and the radio receiver then is utilized to repeat the program from the records. The device cuts and grooves its own records. Disks come in standard sizes, and are made of aluminum alloy, not easily broken or damaged. The instrument, including motor, turntable, volume control, microphone, and switches, is contained in a compact case.

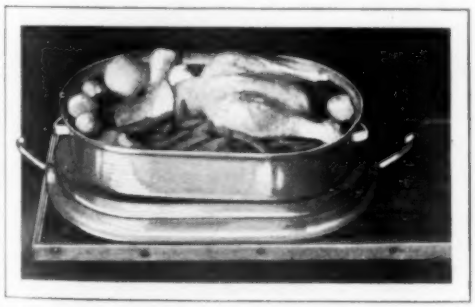


BILLIONS OF FISHES PRODUCED IN GOVERNMENT HATCHERIES

Despite some unfavorable weather conditions, the bureau of fisheries last year established an all-time record for the number of food fishes propagated and distributed. A total of 2,553,481,000 eggs, 4,766,831,000 fry and 2,553,481,000 fingerlings were produced in the federal hatcheries and distributed throughout the country. Eggs and fry of winter flounder were greatest in number, followed by cod, yellow perch, pike perch and whitefish. In addition, 161,000,000 fishes were rescued from overflow lands near the Mississippi.

COOKER ON CAR RUNNING BOARD GETS HEAT FROM EXHAUST

Motorists now can cook their meals as they travel by means of an aluminum cooker which attaches to the auto running board and utilizes the waste heat from the exhaust. About eighteen inches long and twelve inches high, the cooker rests on an asbestos pad and is connected to the exhaust by a flexible pipe. When the car is in motion, the stove is heated in less than a minute. Food in the flat pan, over which fits a tight black lid, can be fried, baked or roasted without cost of fuel, loss of time, or interference with the motor. The metal top fastens so securely that there is no rattle, while gas fumes are exhausted below and do not come in contact with



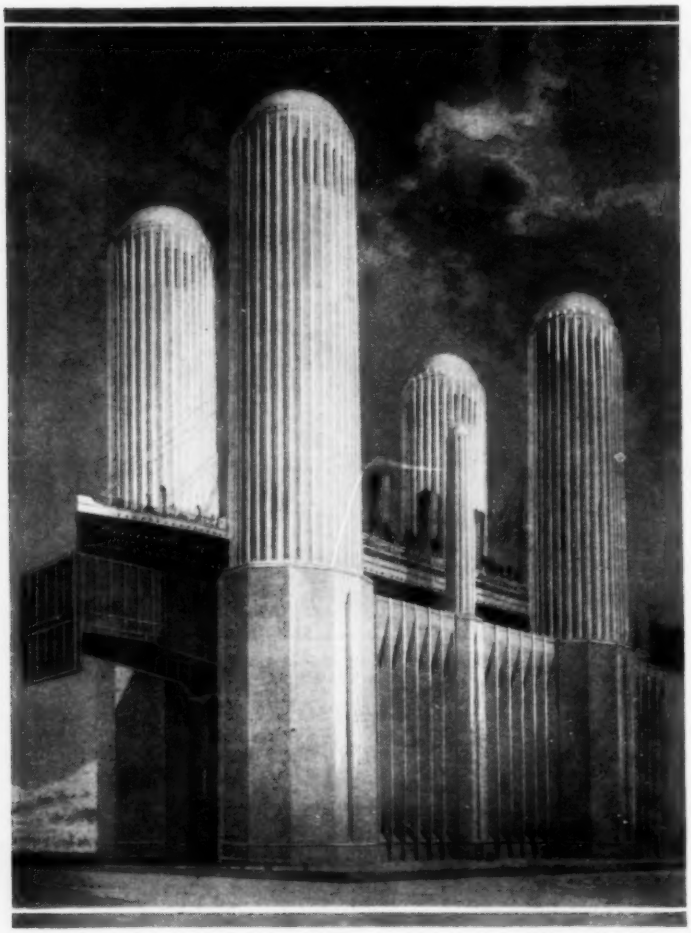
Aluminum Cooker for Auto Running Board, Which Utilizes the Waste Heat from the Exhaust

the running board stove which can be switched on or off by the motorist, or even regulated to cook faster or slower. For the tourist, it eliminates much camping equipment, and for the picnic party, it assures a hot lunch as soon as the picnic ground is reached.

Sea-Onion Plant, the Bulb of Which Furnishes a Poison for Rats but Harmless to Humans

PLANT POISONS RATS AND MICE BUT NOT HUMANS

Because most rat poisons also kill other animals, and even humans through accident, the biological survey has been experimenting with a vegetable poison which is fatal to rats and mice, but is virtually harmless to other living creatures. The plant from which the poison is obtained is the "sea onion," belonging to the lily family, and also known as the red squill. It grows wild on the hills bordering the Mediterranean, the onionlike bulbs sometimes attaining a weight of ten or fifteen pounds. One grain of the powder from the dried bulb will kill a large rat. White squill is familiar in medicine, being useful as a heart tonic and emetic. Red squill has the same properties, but also contains a poisonous element not yet isolated. If swallowed in any quantity by a person or domestic animal, the red squill causes vomiting which is one reason why it does no harm, but, oddly enough, rats and mice cannot thus eject the material, and thus the poison, so deadly to them, kills them quickly. The biological survey has been growing the plants in greenhouses and drying and pulverizing the bulbs to make the poison for rodents.



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Proposed Elevator for Ships Which Would Raise the Largest Vessel 200 Feet in the Air When Repairs Are Necessary

ELEVATOR THAT RAISES SHIPS PLANNED IN GERMANY

Two German architects have drawn plans for a giant ship elevator that would raise the largest vessels to a height of 200 feet for overhauling without damage to the boat. A drawing of the proposed structure shows two massive walls surmounted by four huge towers with a slip between them into which the ship is run.

LOW-COST PAVING MATERIAL COMBINES WITH DIRT

Ordinary earth, instead of sand, gravel and stone, is used as an aggregate with a patented road-surface binder known as bituminous concrete, which, it is claimed, will produce well-constructed highways at about one-half ordinary paving costs. The material is mixed in a ratio of one to seven with any handy dirt in the path of construction, forming an asphaltic cement surface similar to the asphaltic concrete now in general use. It is handled hot, rolled in the usual way, has great tensile and compressed strength and is used with a non-skid surfacing. The material also has been tested for sea docks, gun emplacements, garage floors and for basements. The subcoat, or surface binder, sets in less than an hour, and it is also claimed that it can be laid in rain or cold weather.

HORSELESS POLO IS PLAYED ON FOOT

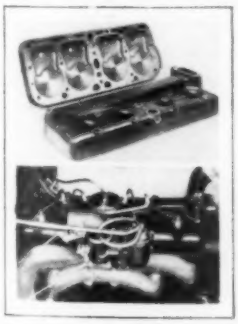
Miniature polo was introduced on the Pacific coast as a sport almost as exciting as the real game, when the grooms of one polo stable challenged those from a rival outfit to a polo match without ponies. The horseless contestants play the game according to standard rules.

Polo Game without Ponies; It Is Played with Short Mallets According to Regulation Rules

DOOR OPENS ON RIGHT OR LEFT TO SAVE STEPS

Equipped with two sets of hinges and two handles, doors for refrigerators, cabinets and many other articles can be opened from the left or from the right. The advantage of such a convenience is apparent. Working at a table or sink in the kitchen, the housewife would be saved many steps in using the refrigerator as she could open and close the door from the left or from the right side. Cabinets and other objects with the "two-way" doors could be used where the usual door arrangement would conflict with other articles of furniture, and on cupboards and similar objects overhead, the doors could be opened in such a way that they would not endanger the person working underneath. It is impossible to pull the door from its hinges, for when one side is even slightly ajar, the other is securely locked. The hinges are flush with the sides of the cabinet, so that the only extra hardware exposed for cleaning is a handle.

NEW HIGH-COMPRESSION HEAD INCREASES AUTO SPEED



To increase the power and speed of Ford cars, an L-type high-compression head is being offered to replace the stock head without disturbing or changing the mechanical set-up of the engine. It can be combined with a downdraft carburetor without adding any moving parts or changing the valves. The head is of cast iron with a special combustion chamber to handle the increased compression. The makers claim for it a substantial saving in fuel and an increase in speed up to more than eighty miles an hour. Compression ratios of seven to one or six to one are offered, the former for anti-knock fuels.

Apparatus Which Makes a Moving Picture of the Human Voice; on the Screen Is Shown the Image of One Voice

"MOVING TALKIE" OF THE VOICE AIDS IN LANGUAGE STUDY

It is now possible to make a "moving talkie" of the human voice or of any other sound, and exhibit it in a lighted room before a large audience with a device developed by the Westinghouse research laboratories. The picture of the voice shows curious lines wriggling from left to right, across a screen about the size of a large plate. "High" and "low" spots are indicated, making it possible for observers to distinguish the pure from the compound notes or tones which are heard by the human ear. The device enables engineers to examine the high and low levels of various sounds and thus, by dovetailing high spots with low ones, to produce or approach silence as far as hearing is concerned. This is expected to be important in combating annoying city noises. In schools and colleges, it is expected to be helpful in language study by photos of correctly pronounced foreign words.

"SANDWICH" OF WOOD-ASBESTOS FIREPROOFS DOORS

In erecting a large building, the designers specified a "sandwich" door of wood and asbestos as a substitute for steel and to conform with the fire regulations. The cores were of wood with a layer of asbestos, topped by a surface veneer on each side. In event of fire, the veneer would burn but the flames would stop when they reached the asbestos layer.

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Demonstrating a "Silent" Note Paper before the Microphone; It Is Noiseless When Shuffled

"SILENT" PAPER IS DEVELOPED FOR BROADCASTING

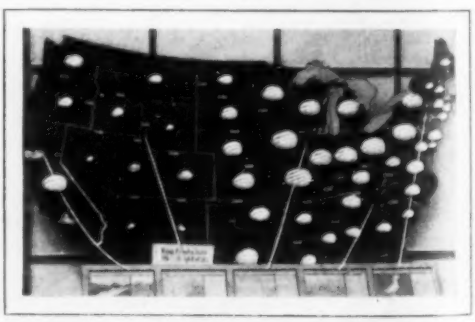
. To end the harsh crackling sounds produced by ordinary note paper in the hands of a speaker before the microphone, a special "silent" writing paper is now being used in some radio-broadcasting studios. This paper can be shuffled or crumpled without making any sound which would register on the recording apparatus.

TWO WINGS OR FOUR ON PLANE AND THE REASON WHY

If the golden plover can fly 2,000 miles across the sea and the wild duck is able to sweep down the sky at 100 miles an hour with only two wings, why has man found it necessary to equip himself with four in a "biplane" arrangement that is like no living creature the skies ever knew. Why do so many flyers prefer this "flying birdcage" to the graceful monoplane that rides the winds like a soaring gull? The most important reason lies not in increased flying ability but in added strength. For the same structural weight, the biplane is far sturdier and more enduring than the monoplane. Its wings are braced like the beams of a bridge—held rigid by taut wires of enormous strength. The complete wing assembly on the high-powered pursuit fighters used by the army and navy will stand up under a loading twelve times the normal weight of the ship. For the same carrying capacity, the biplane is much smaller than the monoplane. This is not only true of the span of the wings but the fuselage is shorter as well. Due also to this smaller span and shorter tail, the biplane responds more quickly to the controls. It can snap into and out of maneuvers with greater speed and requires less room in which to turn or change course. The pilot of an open-cockpit, one, two or three-place biplane has better visibility than he would have in a monoplane of the same class. The truss of the biplane takes most of the load, and the wing panels themselves can be made quite light. Therefore the biplane makes a lighter ship. This means either better performance or more pay load, whichever is most desired. So, as a general proposition, the biplane seems to be the best type for high-speed, high-performance planes, such as fighting craft, and high-powered private planes. Monoplanes have smoother lines, slightly better aerodynamical efficiency, and are steadier in the air. They are easier to design and less expensive to build.

EGG MAP SHOWS AT A GLANCE CENTERS OF PRODUCTION

Annual production of the American hen is clearly visualized on an egg map of the country constructed by the department of agriculture. A large board is cut in outline to represent a map of the nation, and the egg production of each state is represented by imitation eggs of different sizes.



An Egg Map of the United States, Showing at a Glance Relative Egg Production of Each State

Iowa is dignified by the largest egg of all, with Missouri, Illinois and Ohio following in order of size. The map shows at a glance the importance of the various states in terms of egg production.

Is Main Street Doomed?

By CRAG DALE

LOOK at it!—the humble gasoline filling station, ready to serve any automobile with fuel.

If this filling system of distribution works with the automobile, why not extend it to staple articles of food and clothing? Already power is sold that way. Light sockets are electrical filling stations, maintained by a central-power unit.

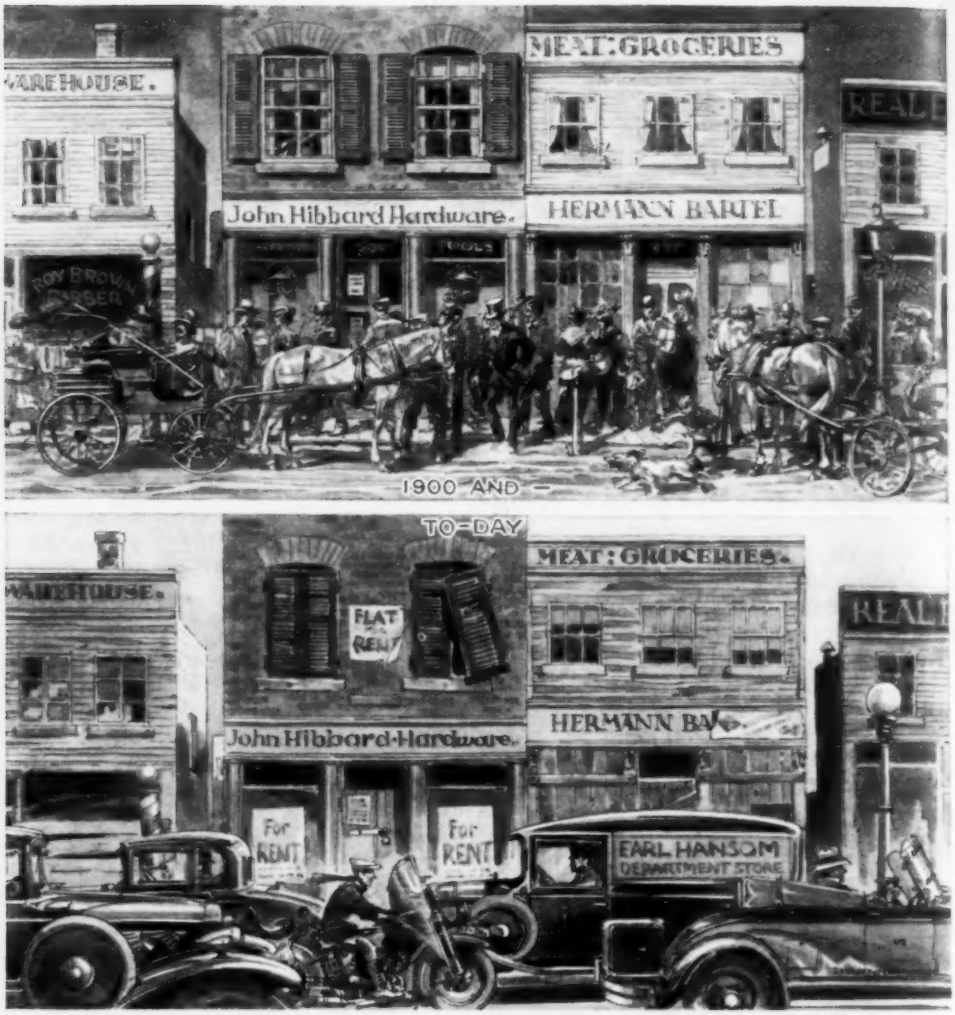
In the opinion of Frank Lloyd Wright, an architectural pioneer of international fame, the gasoline-filling station rapidly is becoming a symbol of a trend away from Main Street—a centralization made necessary in the past by the inefficiency of individual transportation.

At every crossroads, and between them, stand gasoline-filling stations ready to serve any automobile with fuel. Since this system of distribution works so well with the automobile, suggests Mr. Wright, why not extend it to staple articles of food and clothing? And indeed in many places throughout the country Mr. Wright's idea already has been translated into action.

Government statistics show that there now are 110,000 roadside-stand owners, almost all of whom expanded from filling stations. Of that number, 45,000 are permanent year-around operators, serving not only their own communities but tourists as well.

The 16,609 retail-store operators who went into bankruptcy during the first eleven months of 1930 with liabilities of $244,578,-

Artist's Drawing of One of California's Marketing Centers, Where Even Theater Tickets Are Sold; It Has Grown Up around the Easily Accessible Filling Station

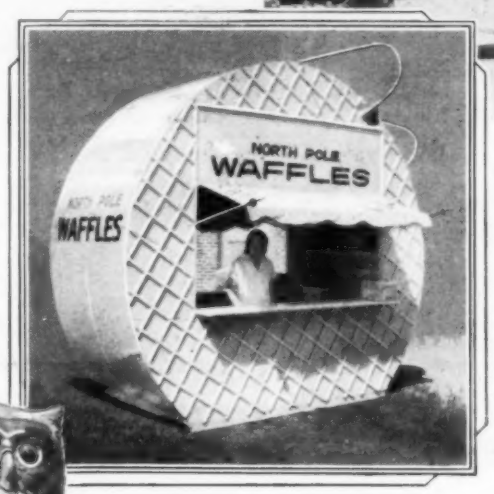


This Changing World and What Has Happened to Shop Keepers Since the Man on Foot Has Taken to the Crowded Roadway with Its Ever-Present "No Parking" Signs

000, face department of commerce figures showing that roadside marketing in 1930 took from the ordinary retail business of the country $500,000,000. In other words, it would seem that the business taken from retail stores last year by gasoline-filling stations and their accompanying roadside-marketing facilities more than doubled the total losses of the 16,609 retail bankruptcies.

A movement now is on foot, and has made great headway, to bring about a co-operative organization of filling stations engaged in selling commodities other than gas and oil. The latest census of gasoline-filling stations shows 317,000 in operation. That figure includes 6,000 owned and operated by the larger oil-producing companies, such as the Standard Oil company, which already is engaged in distributing tires through the service stations it owns or controls. An equal number is owned by the larger oil-producing companies but operated under lease. Independently organized companies operate 8,000, while individual oil producers and private operators maintain 105,000 filling stations. The remainder are run in connection with garages or are maintained as roadside pumps.

It is Mr. Wright's opinion, and in this he is supported by industrial leaders, that the trek to the city is about to be given the "to the rear—march" order by the very force of economic pressure, and the change which has been brought about in society by the use of the automobile. Mr. Wright holds that the automobile and the filling-station system have made possible man's accommodation to the country. The city, he thinks, served its purpose in a day when transportation and communication were undeveloped. But now, he believes, homes and industries might better establish themselves near public highways far from present congested areas. Mr. Wright's ideas are borne out by the latest estimates of the government, which show a larger population on American farms at the beginning of 1931 than at the beginning of the previous year. For the first time in ten years, according to these estimates, farm residents have increased in number. More than 1,500,000 left the farms last year for the cities and 1,392,000 moved back to them. This would seem to show a small difference in favor of the city-ward movement, but the normal increase by births in the farming communities makes the net result of 208,000 more souls living on farms now than a year ago.



Three Types of Quaint Roadside Stands That Attract California Motorists

Added to that might be considered, in connection with the development of commodity distribution by filling stations, the fact that last year, according to the American Tourist Camp association, there were 6,000,000 campers using 2,000,000 automobiles on the highways spending an aggregate average of forty-six camping days at an expense of $7 a day per car. The Hotel Men's association estimates that in 1930 tourists other than campers contributed $12,000,000 to the revenues of hotel keepers in the nation.

Other statistics show that in the east and middle west the regular trade habit of farm homes is in the nearest town which averages a distance of five and a

One of California's Attractive "Drive-In" Markets, Where Everything Is Easily Available for the Motorist, Including a Free Pony Ride for Children

half miles from the farm. Observation has shown that, in many instances, the modern filling station already has supplanted the customary crossroads store as a distribution center for rural communities, and when it is taken into consideration that the average farm family consists of five persons, it may readily be understood that the revenue of a filling station which also operates as a general store is far from inconsiderable.

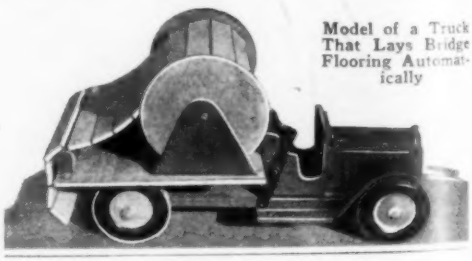
The newer ideas of merchandising which stress the handling of standard package goods, and the development of refrigeration, which would make it possible for any filling station or corner store to hand out meat cuts or perishable products as they would a package of breakfast food, also add materially to the possibilities that present themselves to filling-station operators. Indeed, one of the major telegraph companies has been far-sighted enough to appreciate the value of filling stations as distributing units and has recently announced that all filling stations operated by a certain oil company would henceforth be receiving branches for telegraph messages.

The annual increase in highway mileage apparently increases the potential efficiency of filling stations as distributing units, especially since government traffic studies show that there is an ever-growing tendency on the part of the traveling public to avoid centralized traffic.

In some communities, notably in Texas and California, it has been proved that motorists would far rather do their shopping in the place where they have to stop to replenish fuel for the car, thus avoiding the additional stop which shopping at an ordinary retail store would entail.

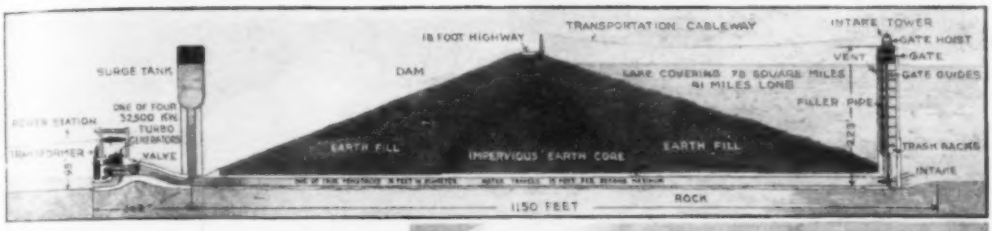
TRUCK LAYS BRIDGE FLOORING AT FIFTY FEET A MINUTE

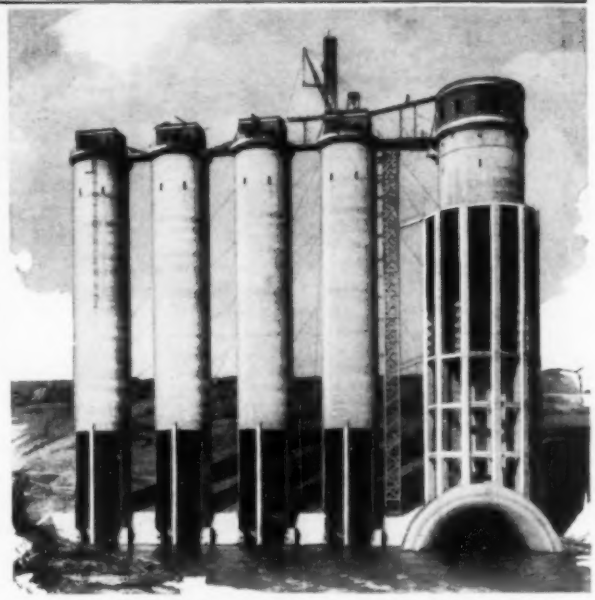
Wooden planks for bridge flooring or corduroy roads are laid automatically by a motor truck recently tested in model form. The planks, joined by hooks, are unrolled from a large reel at the rear of the truck. The inventor claims a full-size machine can build a 100-foot bridge of wood planks in two minutes. It is expected to be useful particularly in fording creeks and swamps.



Model of a Truck That Lays Bridge Flooring Automatically

MILE-LONG EARTH DAM IS IMPERVIOUS TO WATER



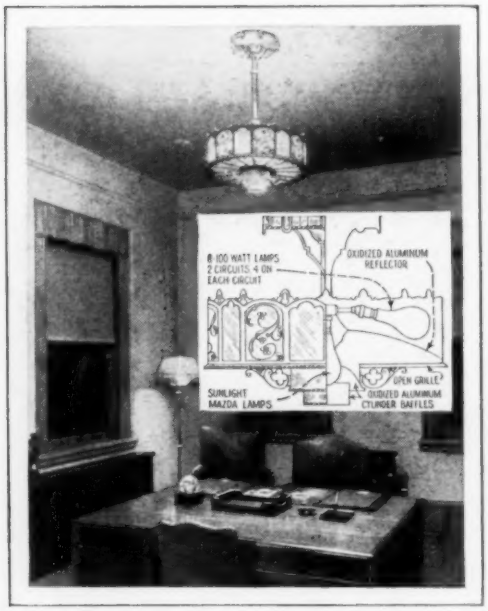


Above, Cross Section of Saluda Dam and Power Project; the Dam Is Made of Earth; Below, the Intake Towers

One of the largest sources of hydroelectric power in the world is made possible by an earth dam nearly a mile and one-half long which is more impervious to water, according to engineers, than concrete would be. This is the recently completed Saluda dam, near Columbia, S. C., which spans the Saluda river and valley for 7,838 feet, the fill being 1,150 feet wide at the base and rising 208 feet above the river bed. It retains a lake over forty miles long and fourteen miles wide, draining an area of 2,400 square miles. The reservoir, containing 763,000,000,000 gallons of water could supply 160 cities of 50,000 population for a year, and more than 170,000 horsepower has been conjured from the river. Nearly 100,000 acres of land were purchased for the project, including 1,100 tracts occupied by 4,000 people, and schools, churches, cemeteries and homes were moved from the area. The interior of the dam was formed by the washing in of fine clay to make a water-tight core. A power station below the dam has an ultimate capacity of 200,000 kilowatts. Generators weigh 340 tons each, and the water wheels that drive them weigh thirty tons each. Water to turn these turbines flows beneath the dam through four huge penstocks, the water entering the penstocks through four large intake towers, thirty feet in diameter and 223 feet high.

SINGER FOR RADIO HEARS VOICE AS IT COMES OVER AIR

Radio singers who entertain over WGY, the General Electric company station, now can hear themselves as others hear them. A film sound recorder has been installed as part of the studio equipment. It is placed in another room and connected by wire to the microphone, recording the singer's voice exactly as it would be heard through a loud speaker after being picked up from the air. Experience has taught that a fine concert voice may be a failure after it has passed from transmitter to receiver and loud speaker, and the recorder enables those in charge of talent to study a new voice, and the singer to hear himself. The instrument also is used in training announcers to correct faulty speech, and in experimenting in the placing of orchestra instruments with respect to the microphone, or in the recording of feature programs during rehearsal.



Sunshine Ceiling Light Which Emits Ultraviolet Rays; Insert Shows How System Operates

SUNSHINE CEILING LIGHT GIVES ULTRAVIOLET RAYS

Both homes and offices now may be equipped with ceiling lighting fixtures which serve a double purpose, supplying both illumination and health rays in the form of ultraviolet light. The fixture furnishes about eight times as much illumination as ordinary ceiling lights without any glare, in addition to the artificial sunshine. There is an indirect-lighting portion containing eight 100-watt incandescent lamps equally spaced and connected to two circuits so one of them can be turned off. These lamps supply one-eighth of the illumination of eighty foot-candles, the remainder and the healthful ultraviolet rays coming from a single sunlight lamp, drawing some 300 watts and arranged inside an oxidized-aluminum reflector. A series of aluminum rings, placed one inside the other to form a reflector, prevents glare and distributes the light uniformly. The sunshine lamp itself consists of a combination of incandescent filament and a tungsten-mercury arc inside a bulb of special glass. It requires a transformer which ordinarily is located in the ceiling above the fixture, or elsewhere if more convenient.

GOLD SUPPLY IN SOUTH AFRICA NEARING EXHAUSTION

After the next fifteen years, the present gold mines of South Africa, which now supply over half the entire world output, are expected to be near the end of their production, mining engineers estimate. When that time comes, the future production of these mines will depend on the possibility of mining and milling profitably the large tonnage of relatively low-grade ores in the area. Following the decline that set in after the world war, the production of new gold now is mounting throughout the world. Since the discovery of America, it is estimated 40,000 tons of gold have been produced, and for years South Africa has stood first, and may be expected to do so again.

SLOT MACHINE TICKET SELLER FOR PARIS BUS SYSTEM

American visitors to Paris who have wrestled with the French language in trying to explain the kind of bus tickets they desired now can purchase the tickets from slot machines. These automatic ticket sellers are placed at bus stops. The busses have no conductors, the passengers canceling their own tickets when they enter the vehicle, the driver watching the operation. Some machines supply tickets at ordinary rates when coins are dropped in them, while others issue pasteboards at reduced rates to injured war veterans.

Slot Machines on Paris Street Which Dispense Bus Tickets When a Coin Is Deposited

INDOOR TROUT POOLS PROVIDE OUTDOOR THRILLS

Indoor Trout Pool Where City Anglers May Enjoy Sport without Taking Time for Fishing Trip

Those who have not the time to go fishing now have the fishing brought to them. The first of a group of indoor fishing pools has been opened on the Pacific coast. The pool, located in a large building, is stocked with trout, and anglers may step in off the street and hook their dinner direct from the miniature stream. They are charged a fee for each fish caught, and have the option of taking their catch home or having it cooked for them in a kitchen on the spot. Since trout demand water that is well aerated, the pool is equipped with a pump that operates a waterfall of aerated water, recirculating the supply with a small amount of fresh water added periodically. Outdoor pools also are being planned, as are casting pools where experienced fishermen may practice this art.

ROMAN CANDLES SCARE BIRDS ROOSTING ON BUILDINGS

Roman candles are being employed successfully to rout birds which become pests to office buildings by flocking there in thousands to roost at night. Starlings recently infested the business district of Providence, R. I., doing damage to buildings and making an annoying racket each evening as they fought for roosting places, it being estimated that 10,000 rested nightly on one structure alone. Four steeplejacks were employed on this building, and as soon as the birds had settled for the night, set off 300 Roman candles. The next night only about 1,000 birds returned and these were frightened away with more candles. After that the birds stayed away because, once scared, they do not return to the same roost.

One Hundred

An Electric Machine Which Was One of the Wonders of 1650; Electricity Was Generated by Friction between a Rotating Sulphur Ball and the Hand of a Person Brave Enough to Touch It

JUST a century ago, on an August day in 1831, young Michael Faraday, tinkering in a British laboratory, placed two wires on a ring of soft iron, discovered the secrets of electromagnetism and blazed the way to the miracle-working electric era.

Today, thanks to the genius of Faraday, more than 500,000,000 electric slaves eliminate drudgery in the world's homes, factories and mills, while a vast horde of harnessed horses speed electric trains at 100 miles per hour, span the seven seas with fast greyhounds, encircle the earth in the fraction of a second with radio messages, as magical electric energy performs the will of man.

From a few crude pieces of metal in Faraday's hands, the electric industry has grown to gigantic proportions, more than fifty billion dollars being invested in its generation, transmission and use. On the American continent alone, more than 125,000,000,000 kilowatt-hours of electric current are generated annually, and the burden-bearing marvel is being extended at a cost of more than a billion dollars every twelve months.

Seventy out of every hundred American homes are now using electricity, while industry is eighty-per-cent electrified. Each factory workman now has at his command four and a half horsepower of electrical energy. His producing capacity, thanks to this dependable aid, equals that of forty-five men of the pre-electric era. Mysterious electric energy is the most flexible of power sources, capable of operating a measuring stick accurately to three-millionths of an inch, or being concentrated, 100,000 horsepower at a time, for the performance of a single task.

Ever since the beginning of the race, man had trembled at the flashing lightning, had drawn sparks from amber and a crackling thunder from the fur of a cat, yet not until Faraday's epochal discovery did man really set forth upon the new highroad of freedom. For centuries mankind had amused itself with the lodestone and the compass. But until Faraday's discovery, electricity and magnetism seemed distinct, but the genius of this research worker united them into one range of phenomena, and soon there developed a hundred uses of "juice," commercial and scientific, culminating in our own electric era.

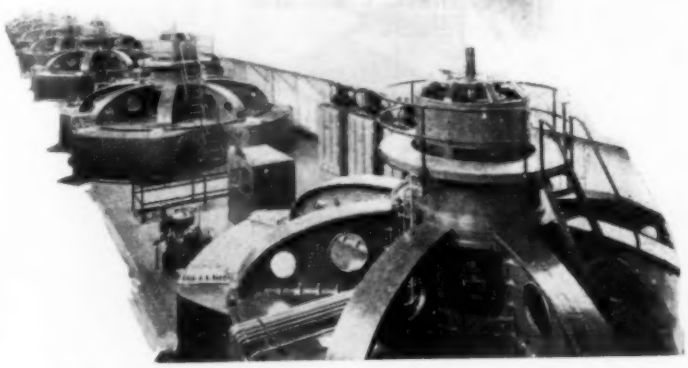
Marvelous as have been the achievements of electricity, engineers advise that

Years of Electricity

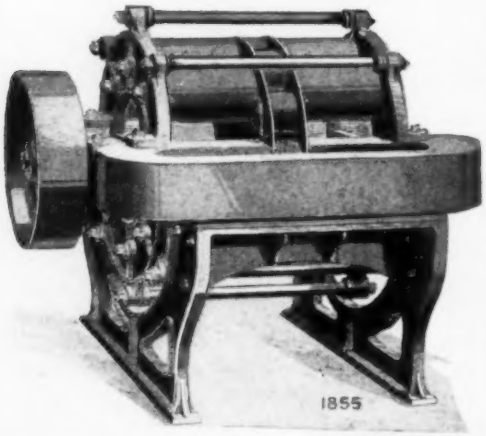
the human race has barely crossed the threshold. Slowly man is conquering the marvels and mysteries, each new day witnessing new applications. There are scientists today who declare that life itself may be found to be electricity.

Faraday reached out and plucked electricity from the air, and still other workers discovered that it existed in chemicals. The story of the simple steps which blazed the way to our own day read like pure romance. Otto Von Guericke was the first man to actually generate electric current. In 1650 he built a cumbersome machine consisting of a ball of sulphur mounted on a shaft which could be rotated. Current was generated when the shaft was rotated and the hand lightly pressed against the ball. He also discovered that electricity generated could be conducted away from the sulphur by a metal chain from which sparks could be obtained, and thus was a pioneer in setting men forth to generate and transmit current.

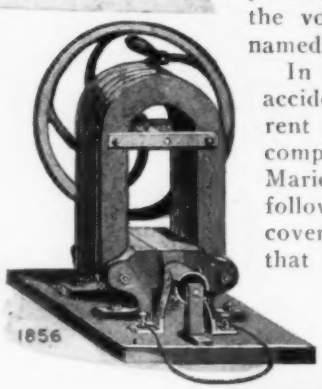
In 1729, Stephen Gray demonstrated that electricity could be conducted about a thousand feet by use of a hemp thread supported by silk thread, if no metal was used. In 1733, Charles



Top, Painting of Thomas·Edison and His First Electric Lamp and Dynamo; Below, Largest Automatic Electric Generating Station



du Fay discovered that those substances which were electrified if rubbed, became insulators, and those which could not be electrified, were conductors.

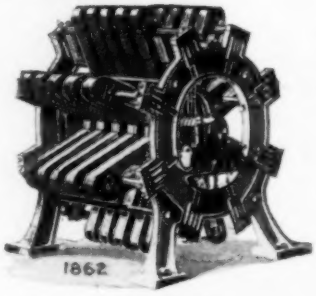


In 1745, Von Kleist invented the Leyden jar, forerunner of the condenser, attempting to store electricity. In a glass bottle he placed a cork with a nail through it, touching the water stored inside. Holding the bottle in one hand and turning a frictional machine with the other, he filled the bottle with electricity. After spinning the machine for a few moments, he pulled the bottle away and touched the nail with his hand. The shock threw him down and very nearly stunned him.

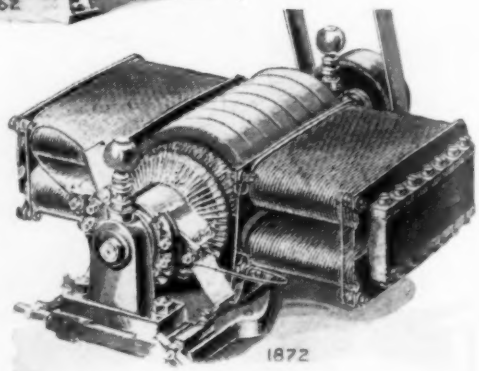
Benjamin Franklin made several experiments with the Leyden jar. Connecting a battery of jars in parallel, he produced a discharge strong enough to kill a chicken. His most famous experiment was the proof that lightning is electricity. This he accomplished in 1752, by flying a kite in a thunderstorm, and drawing electricity from the clouds with which he charged jars and drew sparks from a key attached to the kite string. Modern scientists marvel that Franklin was not killed.

In 1785 Luigi Galvani, an Italian scientist, held the legs of a frog with a metal clamp and, cutting the skin with a scalpel, permitted the clamp and scalpel to touch. To his utter amazement the frog's legs twitched. He repeated the experiment and proposed a theory of animal electricity. Alessandro Volta, professor of an Italian university, repeated the experiments and discovered the clamp and scalpel must be of different metals. Following up this idea, he made a "pile" of silver and zinc disks with pieces of wet cloth, saturated with salt water, between the disks. From this the voltaic pile was perfected, and in honor of its inventor, the volt, unit of electric pressure, was named after him.

In 1820, Oersted, a Danish professor, accidentally discovered that electric current flowing in a wire would deflect a compass from its true position. Andre Marie Ampere, French mathematician, followed this up and made several discoveries, among which was the idea that current flowing in a coil of wire gave it the property of a magnet, and thus effected the long-sought link between electricity and magnetism. The ampere, unit of flow of electric current, was named in his honor.



One of the most important laws of electricity was discovered in 1825 by Georg Simon Ohm.

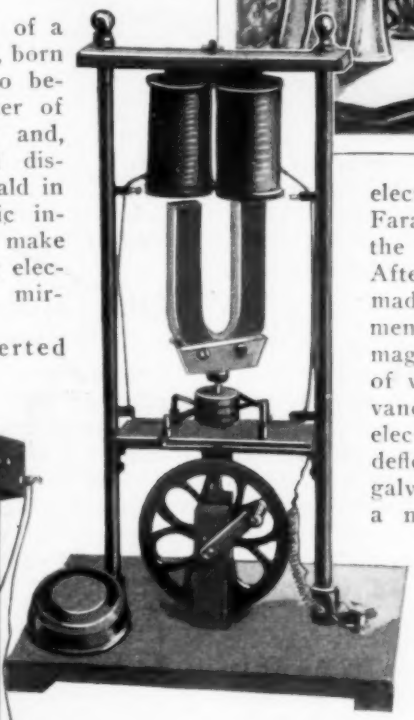


Examples of Some of Early Dynamos; the Armature of the One at the Bottom Is Drum-Wound

of Cologne. It was known that the rate of transfer of heat from one end of a metal bar to the other was in direct proportion to the difference in temperature between the ends. By analogy and experiment, Ohm discovered that the current in a wire is proportional to the difference of voltage (electric pressure) between the ends of the wire. Also, he discovered that the current in the wire is inversely proportional to the electrical resistance of the wire. These became the basis of the Ohm law that current flowing in a circuit is equal to the voltage divided by the resistance, and after this trail blazer was named the ohm, unit of electrical resistance.

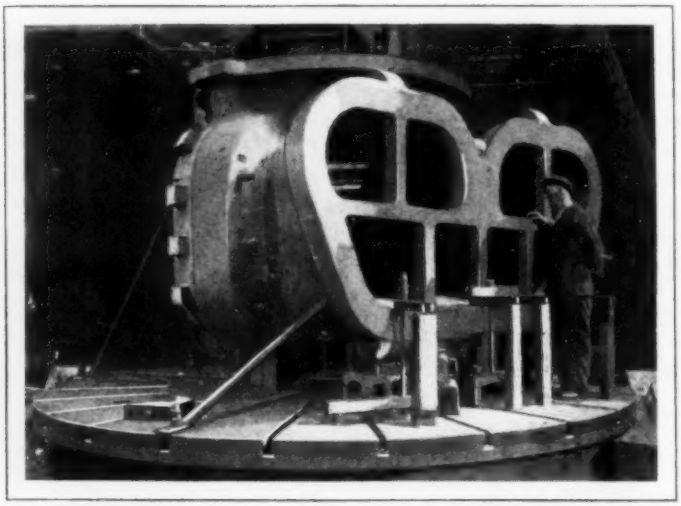
Michael Faraday, son of a poor country blacksmith, born in 1791, was destined to become the miracle worker of the nineteenth century and, using the accumulated discoveries of the past, herald in the new electromagnetic induction which should make all of use in harnessing electric energy to perform miracles for humanity.

Ampere having converted electricity into magnetism, Faraday tried to discover if the reverse were possible. After months of study he made the epochal experiment of moving a permanent magnet in and out of a coil of wire connected to a galvanometer, which generated electricity in the coil and deflected the needle of the galvanometer. Then he made a machine consisting of a copper disk mounted on a shaft so that the disk could be rotated between the poles of a permanent horseshoe magnet, a copper brush rubbing against the edge of the disk as it rotated. Thus electromagnetic induction was discovered.



Top, **Michael Faraday, Pioneer Electrical Wizard; Center, Dynamo of 1832; Below, an Edison Dynamo**

Faraday rested content upon his discovery and did not follow it out to a conclusion, and it remained for other men, adopting his methods, to build the first electric dynamo and generator. Not until 1871 was the dynamo a commercial success, when Gramme applied the ring armature. This gave man a machine which not only produced electric current, but caused it to produce power.



High-Pressure Casing for One of Two 160,000-Kilowatt Tandem-Compound Steam-Turbine Generators, Used by a Brooklyn Electric Company

The evolution of the devices which today generate, transmit, harness and convert electrical energy to perform the will of man, was slow and called for the combined endeavors of a host of men. Pixii, a Frenchman, at the instance of his friend, Ampere, brought out a dynamo that generated current by revolving wound electromagnets instead of a disk. He likewise perfected the first two-part commutator, and became the father of alternating current.

The real beginning of electric lighting dates from 1876, when Jablochkov illuminated a number of Paris boulevards with his "electric candle," an arc light consisting of a pair of carbon rods held together side by side, yet insulated from each other. Charles F. Brush, an American inventor, improved upon this idea, as did Thomas A. Edison, who deserted carbon for filament imprisoned within a glass bulb, inventing the incandescent electric lamp in 1879.

A mighty pioneer was he who first kindled fire. At will, he was able to enjoy light by night, warmth in winter, new feasts as he roasted roots, nuts and meat. In a later age his children caused the flame to divide copper from its ores, and make iron into spears and knives.

But the electrician is the marvel-worker of the modern age, with weapons so subtle and forceful that he far outdistances the fire users at every point. He provides us with energy in one phase which may instantly and fully be made to pass into any other phase. A touch of the button and electricity sheds lights as vivid as sunshine; another touch and intense heat throbs in the heart of the oven or crucible, securely mantled against escape. Yet another touch, as we direct a chemical dissolution, as in separating silver from its compounds; or we may effect a union as profitable, building from air the nitrates to fertilize farm and garden. Turn a switch and desire becomes law. Today electricity wields universal empire because it does all that fire did, easier, quicker, cheaper, better, and passes to exploits far beyond the scope of the flame.

AQUAPLANE RIDER MAKES LEAP TO GLIDER IN FLIGHT

Transfer from a speeding aquaplane to a glider in flight was made recently in a test on the Florida coast. The glider was towed by a speed boat and the rider was towed on an aquaplane by another boat. When the glider swooped low over the aquaplane, the rider grasped a dangling trapeze and pulled himself aboard the flying craft.

Aquaplane Rider after Leap to Flying Glider

DATE IS CHANGED BY ROTATING CALENDAR

Desk calendars which change dates automatically when the calendar cases are rotated are eliminating this worry from the routine of the business man. The case is supported on trunnions so it swings on a horizontal axis. Upon each side of the case is an opening so placed that no matter which side faces the front, it will always be at the bottom of the box. The case contains seventeen cards bound with metal, so arranged that as the box is turned on its axle the numbers drop into view in the window in consecutive order. Operation is by gravity, the thickness of the box being such that nine cards will just fill it when stacked one upon another when the box stands upright. In this position, the bottom contains nine cards and the top eight. As it is turned toward the operator, the end containing the eight cards becomes the bottom. While turning, these eight fall by gravity to the back of the box, and as it reaches a position approximately upright, the extra card in the opposite end, now the top, drops into the vacant space. The supporting trunnions are mounted on a heavy base, the front of which contains cards indicating the month and the number of days in each. At the end of a month, if it has less than thirty-one days, the box is rotated until "1" appears.

¶Write our Bureau of Information if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

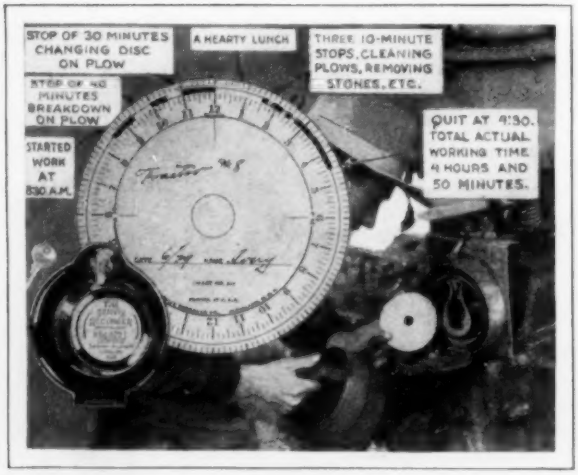
Swimmers in a Balloon Race; after Swimming the Length of the Pool, They Inflate Balloons Until They Burst, Then Sprint Back

BALLOON RACE FOR SWIMMERS ADDS THRILLS TO SPORT

Aquatic balloon racing is finding favor with swimmers who are always seeking new forms of excitement to add thrills to this sport. The contestants swim the length of the pool once, clamber ashore and blow up toy balloons waiting for them to burst. As soon as a balloon bursts, the swimmer jumps into the water and splashes for the starting point.

PENNY VENDER SELLS CIGARETS ONE SMOKE AT A TIME

Vending machines now are appearing on shop counters that dispense one cigaret at a time when a penny is dropped in a slot and a lever is pressed. The supply of cigarets is contained in a glass-inclosed case at the top of the slot machine, and no attention is required other than to replenish it.


STOP OF 30 MINUTES CHANGING DISC ON PLOW
A HEARTY LUNCH
THREE 10-MINUTE STOPS, CLEANING PLOWS, REMOVING STONES, ETC.
STOP OF 40 MINUTES BREAKDOWN ON PLOW
QUIT AT 4:30. TOTAL ACTUAL WORKING TIME 4 HOURS AND 50 MINUTES.
STARTED WORK AT 8:30 A.M.

Work Recorder for Tractor Showing the Busy Time of the Machine, and One of the Waxed Service Charts

WORK RECORDER FOR TRACTOR SHOWS BUSY TIME

In operating a fleet of tractors, efficiency often demands that the owners know just how much work each is doing in order to equalize the burden. For this purpose, a clock may be attached to each tractor to keep an accurate record of busy and idle time for each minute of the day or night. The recorder consists essentially of a swinging stylus or marker and a clock movement, both inclosed in an aluminum case. The pendulum supplies motion to the stylus and any motion which will shake or move the pendulum also moves the stylus. A waxed chart is rotated at clock speed, and the stylus marks the chart during such time as the pendulum is moved by the activity of the tractor. The device can be attached anywhere on the vehicle.

COST OF HOMES TO BE CHEAPENED BY STANDARDIZING

Factory methods, if applied to the building industry, probably would cut the cost of building the simplest types of homes at least fifty per cent. This estimate is made in a report recently submitted by the Regional Plan of New York which favors a far-reaching program of research leading to the cheap production in factories of standardized home units. The report charges the housing industry with lagging generations, or even centuries, behind other industries supplying basic commodities, and studies leading to standardization and mass production of building material are advocated as the remedy for the situation. With proper street planning, and under factory methods, homes could be built to rent for from $5 to $7 a room, it is estimated, the figures being based on the actual building of forty homes from standardized sections. It was found a factory-made wall section, after being put in place, cost $45 as compared with $85 for brick or terra cotta of the same size. The large difference in cost was traced to the waste involved in present methods. While productivity per worker in the automobile industry has increased 172 per cent, that in the housing industry has actually decreased in some of the housing trades as much as fifty per cent.

MIDGET GOLF AND BILLIARDS COMBINED ON ONE TABLE

By constructing a miniature golf course on a billiard table, the main features of both sports have been combined in one game that is proving popular in Australia. The difficulties of both games must be overcome by the players.

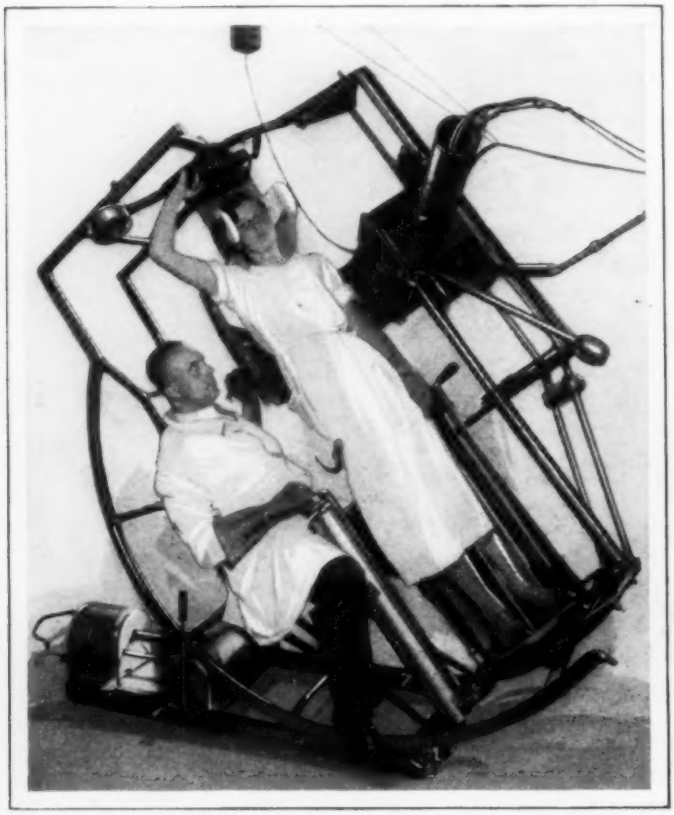
Miniature Golf Course Laid Out on a Billiard Table, Combining Features of Both Sports; the Game Is Played with Billiard Cues

ON THE TRAIL WITH THE ELEPHANT "TAPPERS"

Courtesy H. A. Pelham

Stockade Such as That in Which Elephants Are Trapped in Lower Burma; Natives Tap Sticks to Confuse the Beasts, and a Gate Is Dropped When One of Them Enters the Strong Palisade

One strange species of Asiatic elephant, inhabiting the wilds of lower Burma, makes an annual pilgrimage to the seashore, and this habit is utilized by native elephant catchers in trapping the beasts for transport animals. Ordinarily, elephant trappers avoid making the least noise, but the Burmese natives trap these particular elephants by a systematic method of tapping sticks to confuse them. These elephants, in groups of five or six, make their annual trip to the sea to lick the salt from the dried-up creek beds, and follow regular trails through the forests. Native hunters conceal themselves along one of these trails, and after the animals have passed, fall in behind them and begin tapping slender sticks together. The elephants are alarmed by the strange noise, but usually keep to the trail instead of stampeding, hastening their pace until they reach a fork in the trail. Here the bull leader selects one fork, but a sharp tap in that direction halts him, and he turns uncertainly toward the other path where a second tapping immediately is heard. The animal then usually plunges headlong down a middle path and directly into a strong palisade built to receive him. A native, high in a tree above, pulls a rattan cane, and a heavy teak or hardwood gate crashes down to block the archway. The native who releases the gate must be adept at the job because the bull is the animal wanted, and if the following cows are also allowed to enter the stockade the leader usually batters away until he makes a breach, but if he finds himself alone, he soon submits. If cows are to be caught, not more than three are allowed to enter; then the gate is released before the bull comes through the opening. These elephants are smaller than the Indian animals, and the males are frequently without tusks, standing about eight feet high at the shoulder.



X-Ray Apparatus Set in a Tilting Frame with Comfortable Space for Both the Patient and the Physician in Making Observations

X-RAY APPARATUS ON ROCKERS FOR EASY OBSERVATION

One of the most modern Roentgen institutes in the world is that at Frankfort, Germany, which is provided with the most elaborate equipment for the protection of both the patient and physician in X-ray treatment. One of the wonders of the institute is called the "look through" machine, and enables X-ray observation without danger or discomfort for either the patient or doctor. The X-ray equipment is mounted on a curved frame resembling rockers. The patient rests at full length on the frame and the doctor reclines under the subject in a seat from which he operates the apparatus.

¶Names and addresses of manufacturers of articles described in this magazine will be furnished free by our Bureau of Information.

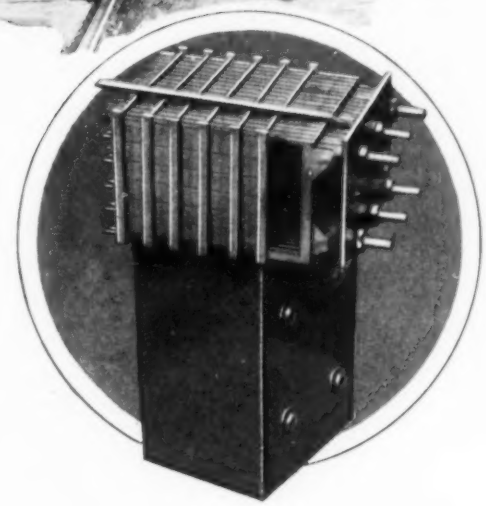
FIND MANY MORE FOODS RICH IN VITAMINS

Recent tests have revealed many common foods have a rich vitamin content heretofore unsuspected. Malted milk is a good source of vitamins A, B and G, but chocolate flavored malted milk is not quite so rich in these vitamins. Water cress contains a rich supply of vitamins A, C and E, and a fair supply of vitamin B. Preserved grape fruit is nearly as rich in vitamin C as the fresh fruit.

RADIO AMPLIFIER FOR VIOLIN TO CONTROL TONE

One violin virtuoso has equipped his instrument with a radio amplifier which increases the tone volume fiftyfold. The amplifier consists of a phonograph pick-up with loud speaker mounted, by means of a bracket, on the tailpiece of the violin, its needle making contact with the top sounding board just behind the bridge. Tone volume is controlled by a potentiometer operated by an assistant who can regulate it at will from the faintest pianissimo to a fortissimo of far greater volume than any single instrument would be capable of producing, yet the tone is without distortion, and even more warmth and fullness. Hence the attachment is of special value in executing triumphal music where unusual volume is warranted. This suffices for one instrument, but in a quartet, a device is added which equalizes and blends the frequencies.

Batteries to Run Train



© Irish Independent

Above, Railroad Car Driven by Storage Battery; Right, the Small Battery Furnishing the Power

FOR years electricians have dreamed of a day when a simple but powerful storage battery would suffice to drive a railroad train at a high speed without needing recharging except at either end of the run.

A train hauled by a 1,000-horsepower locomotive, running at fifty miles an hour, over a stretch of 200 miles on a modern railroad, needs an engine or motor developing a tractive force greatly in excess of 1,000 horsepower.

Brilliant inventors on both sides of the Atlantic have, in the past thirty years, wrestled with this problem. Edison, years ago, invented an alkaline nickel-steel battery which threatened to put the acid lead battery out of business. But the acid battery survived and is still in use, although it cannot give the high rate of current discharge for the length of time required by modern rail transport. It becomes exhausted and requires a considerable time to recharge.

An inventor who can create a battery which can be recharged four times on a run of 200 miles—the operation of recharging taking from fifteen to twenty-five minutes each time—will have brought about a revolution in transportation.

This is the problem, the solution of which is sought by a young professor of University College of Dublin, Ireland, James Joseph Drumm. His discoveries

are embodied in the cells of a new and powerful storage battery. Patent No. 335,587, a few weeks ago recorded in the British patent office, describes it as "an alkaline storage battery wherein the positive electrode consists of a mixture of metallic silver or silver oxide and ceric oxide, and the negative electrode comprises the usual oxides of iron or cadmium or a mixture thereof—an accumulator permitting of very rapid rates of charge and discharge on account of its very low internal resistance, while the energy capacity is of high power to the unit of weight employed."

The Irish Free State government recently arranged for a test of the Drumm battery, in co-operation with the engineers and electricians of the Great Southern railroad of Ireland, when some striking results were attained. A thirty-mile stretch of road, leading from Dublin and having steep gradients, was selected for the trial. Inspection posts and examiners were stationed at every mile of the run, while a group of scientists traveled in the battery coach.

The battery was slung under the frame of the coach, a four-wheeler, thirty-five feet long, with nothing to take up jars and vibrations, except the usual springs. Seventy cells were grouped in the crate driving electric motors attached to each axle. An express-locomotive engineer drove the Drumm-battery coach at top speed, when it developed a maximum of forty-eight to fifty miles an hour, after starting, and accelerated six miles an hour for every second of the run. As soon as the battery coach had completed a round trip, it was connected to the charging station and the battery recharged at the rate of 400 amperes in twenty minutes, although it may be charged at the rate of 600 amperes in ten minutes.

On the day of the test, the Drumm battery coach did 173 miles, and could have covered nearly half as many miles again but for interference with the regular steam service of the line. Another trial run was made in the fall, when the battery coach was driven from 9:35 a.m. till 5:30 p.m., and reached a maximum speed of fifty miles an hour, and an average speed of forty miles an hour for the day. Here are other figures of the run:

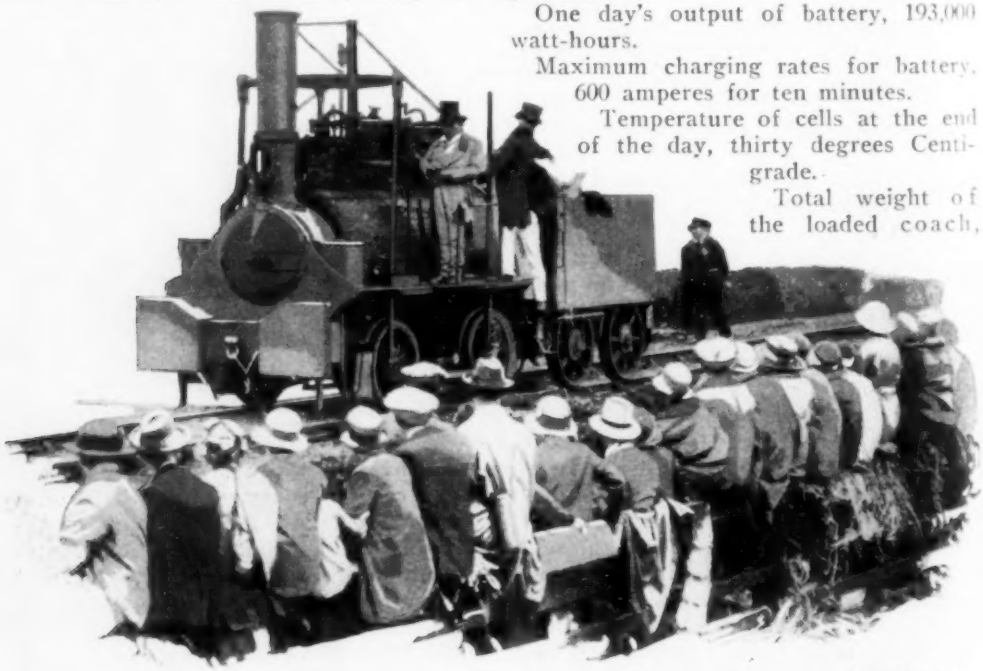
Weight of battery and crates, 5,000 pounds.

One day's output of battery, 193,000 watt-hours.

Maximum charging rates for battery, 600 amperes for ten minutes.

Temperature of cells at the end of the day, thirty degrees Centigrade.

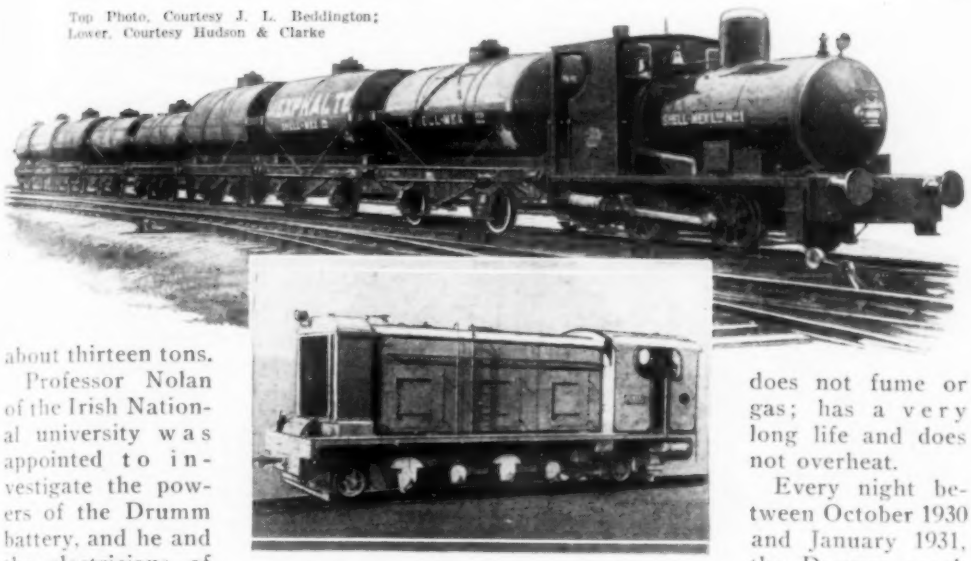
Total weight of the loaded coach,



© London Times

One of the World's Earliest Locomotives, the "Hetton Colliery," Built in 1820; Over a Century Afterward. It Hauled a Train of Cars in England at a Speed of Six Miles per Hour

Top Photo, Courtesy J. L. Beddington; Lower, Courtesy Hudson & Clarke



Top, Fireless Locomotive for Oil Depot Whose Boiler Is Filled Daily with High-Pressure Steam; Below, Geared Type of Oil Locomotive Designed for Mountain Climbing

about thirteen tons.

Professor Nolan of the Irish National university was appointed to investigate the powers of the Drumm battery, and he and the electricians of the Great Southern railroad reported to the Irish minister for commerce and industry. It is officially claimed that the Drumm battery has a fifty-per-cent higher voltage than existing alkaline batteries and can be charged and discharged more quickly and at much higher rates. The battery is simple and inexpensive to construct and can be charged in from eight minutes to one hour as compared with five to eight hours for alkaline storage batteries. It does not fume or gas; has a very long life and does not overheat.

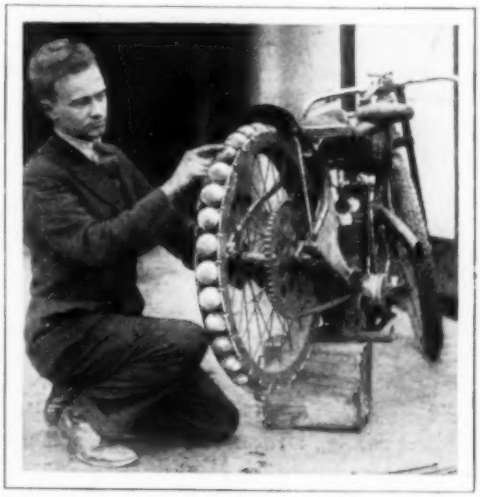
Every night between October 1930 and January 1931, the Drumm coach has been running up and down the railroad between Dublin and Kingsbridge on the Great Southern railroad, carrying the company's employes to and from their homes.

The Free State government is satisfied with the results of the trial runs, and has induced the Irish parliament to vote $125,000 for further tests. By the fall of this year, a Drumm electric train, now being constructed, is planned to run in regular operation carrying passengers.

BALL-BEARING WHEEL TREAD SPEEDS UP MOTORCYCLE

Ball-bearing treads are used by one English dirt-track rider on the rear wheel of his motorcycle to enable him to take turns at higher speed. The curved flange of the wheel rim is fitted with solid spheres larger than billiard balls. Since these free-rolling balls can turn at right angles to the plane of the wheel, the rider can "broadside" on a hard solid surface in making a turn, the machine sliding sidewise on the curves.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.



Ball-Bearing Tread for Motorcycle Wheel, Enabling Racer to "Broadside" on the Turns

Apparatus Which Measures Time a Motorist Requires to Apply Brake after Seeing Red Light

TIME NEEDED TO APPLY BRAKE MEASURED BY EYE TESTS

How long after seeing a red light flash does a motorist begin applying his brakes? To measure this period of time, a machine has been built which shows exactly how long it takes the driver to depress the brake pedal after he has been warned by the flash of a light. The same apparatus can be used to test reaction to an audible signal by using a bell instead of a light. It has been found that the average time between a visual warning and applying the brake is fifteen-hundredths of a second. A car driven by a motorist who reacts to a visual warning in one-tenth of a second, for instance, will travel five feet at thirty-five miles an hour before he steps on the brake, while the car of the man who reacts in one-fourth of a second will travel thirteen feet. In other cases, a mere turn of the wheel may avert an accident, and here particularly the fraction of a second is important.

THE FOGGIEST SPOT

Moose Peak, Maine, enjoys the distinction of being the foggiest spot in the United States, although it brightened up a little in 1930 and had only 1,562 hours, or a little more than sixty-five days and nights, of fog. Its yearly fog average over sixteen years has been 1,607 hours. Runners-up on Moose Peak's record are Libbey island and Petit Manan, also on the Maine coast. On the Pacific coast, Point Reyes light station holds the record, with an average of 1,398 hours per year for forty-five years.

FUEL WITHOUT SMOKE OR DIRT COMES IN PACKAGES

Fuel for open fireplaces that is without dirt, smoke or odor, although it gives out more heat and lasts longer than ordinary fuels used for this purpose, is being offered on the Pacific coast. It is a specially treated coke in pieces about the size of an egg and comes in a neat carton weighing seventy-five pounds. Each carton contains six packages of fuel and the kindling necessary to start it. A package is placed in the fireplace, and a match applied to a circle indicating the position of the kindling. The container makes it easy to handle the fuel, and one bundle burns from four to six hours.

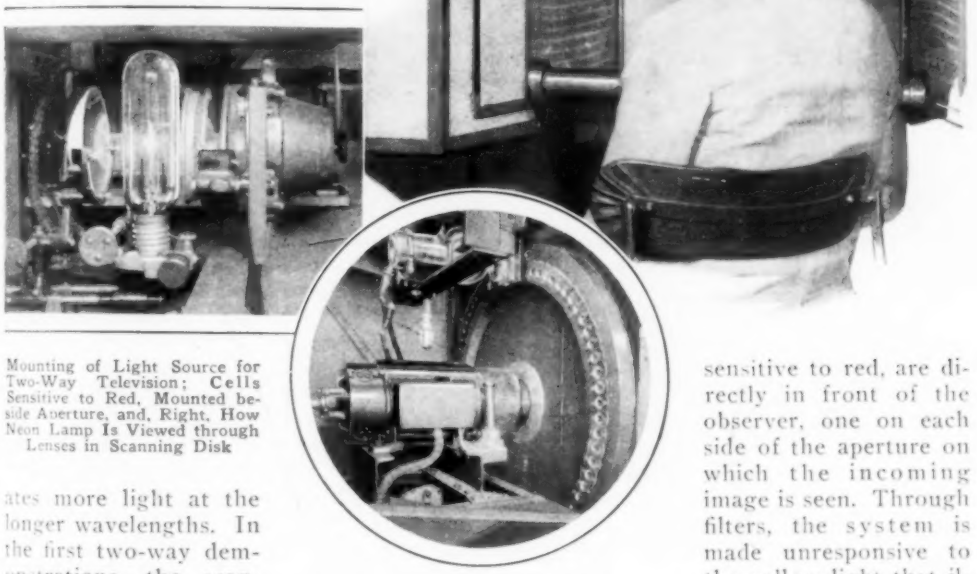
ROBOT HORSE FOR TRUCKING SPEEDS LONDON TRAFFIC

Horses may be supplanted for trucking by a motor unit introduced in London. It is more maneuverable than an ordinary motor truck, being essentially an engine on wheels to be attached to a trailer. The unit was devised especially for service at crowded docks and railroad terminals.

Compact Motor Unit Pulling Trailer; in Crowded Quarters It Is Easily Operated

TWO-WAY TELEVISION IMPROVEMENTS ARE SOUGHT

Two-way television has been much improved recently by the development of several optical features, making the received image more lifelike while the apparatus has been simplified. One noteworthy modification is the use of an incandescent lamp for scanning in place of the arc. The former eliminates flickering, causes the image to be steadier and is simpler to maintain and adjust while the filament is at lower temperature than the arc and radiates more light at the longer wavelengths. In the first two-way demonstrations, the scanning beam traversed a filter that passed only blue light and the photo-electric cells were sensitive chiefly to blue. In the two-way system, a person looks at the incoming image formed by the glow of a neon tube at the same time his own face is being scanned. The blue light made the yellows and reds in the face too dark as compared with the whites, and to obtain greater naturalness a deep-red component has been incorporated in the scanning beam, making it purple instead of blue, and two photo-electric cells, highly sensitive to red, have been added. By scanning from both ends of the spectrum, the effect is much like that which would be obtained by scanning from the middle of the visible spectrum, giving a much more faithful reproduction. The cæsium-oxygen cells, sensitive to red, are directly in front of the observer, one on each side of the aperture on which the incoming image is seen. Through filters, the system is made unresponsive to the yellow light that illuminates the booth. A lens in front of the tube and lenses on the scanning disk focus images of the glowing anode on each hole of the disk. This eliminates the necessity of the large electrode area and high currents employed in the earlier tubes.



Mounting of Light Source for Two-Way Television; Cells Sensitive to Red, Mounted beside Aperture, and, Right, How Neon Lamp Is Viewed through Lenses in Scanning Disk

LOUD SPEAKER FOR WITNESS ENABLES JURY TO HEAR

Shy witnesses in South African courts who refuse to talk louder at the behest of counsel or judge now fill the courtroom with their voices whether they wish or not. Courtrooms are equipped with microphones in front of witness boxes, these leading to amplifiers. Through these the lowest-voiced witness can be heard distinctly in every part of the room.

Aboard A Super~

The Voice of One of Uncle Sam's Sea Fighters Speaks in a Thunderous Roar; This Is the U. S. S. "New Mexico," One of the Navy's Super-Electric Dreadnaughts, Firing a Broadside

By R. B. ANDREWS

FAR out from land on the Pacific, in the dead of night, the battle fleet steams south in preparation for a battle problem. On the bridge of one of Uncle Sam's super-electric dreadnaughts, the "West Virginia," seven enlisted men and the officer of the deck are on duty. Twenty instruments reveal the efficiency of machinery far below and carry messages to various parts of the ship. The officer of the deck scans the sea on all sides, glancing now and then at a clock.

Suddenly he gives an order. A sailor speaks into a tube: "Darken ship!" Far below in the engine room the order is repeated. Switches are pulled. Brilliantly lighted areas suddenly become pitch-dark. The battle fleet, a moment before casting its lights across limitless waters, disappears from the sea. Its ships now are only shadows on the Pacific.

Only one light pierces the curtain of darkness. On the stern of the "California," the flagship, a tiny light escapes through a hole in a three-inch cup—a star-like guide visible only to the ship next in line.

Steadily four powerful electric motors drive the "West Virginia" at twelve knots. A movement is anticipated. Now the time has arrived. The officer of the deck speaks. An enlisted man whispers into the speaking tube. A lever in the engine room is turned. The behemoth lists and slips through the water as she changes her course.

Around her, at 500-yard intervals, other darkened battleships turn in the new direction. They swing into formation just as though they had reached a street intersection. "Tricky to do with a big bucket like this," a sailor remarks. But turn they do.

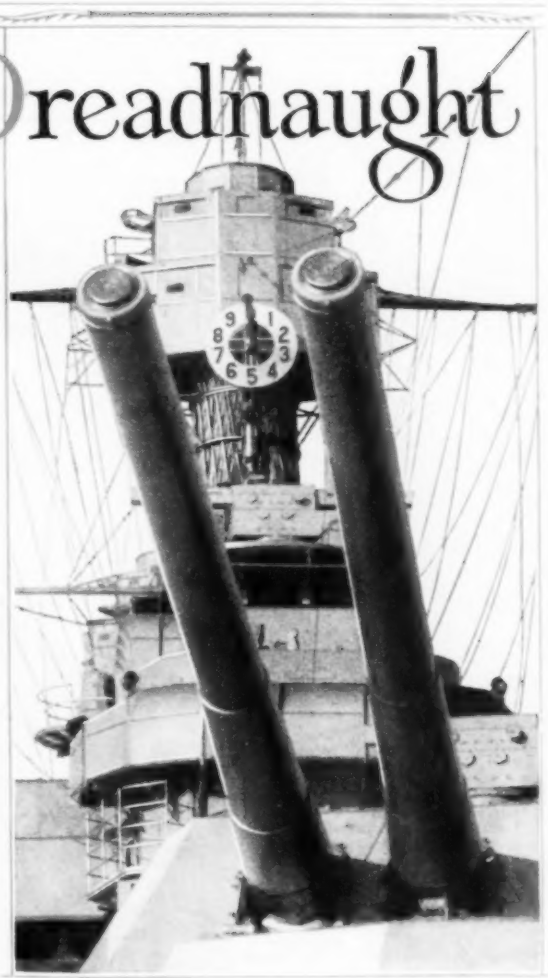
The officer of the deck, responsible for the safety of his costly war machine and her crew, can see only a dark shadow ahead. Yet these ships of the line are so steady and their movements so sure that they can go several hours and continue to keep their relative places in the formation. As they turn, each slides and moves forward possibly 300 feet. Yet there is no danger of collision, for every battleship behaves in exactly the same manner.

Electric Dreadnaught

and when the lights go on, possibly an hour later, one sees them plowing ahead in their original positions.

But the story of the super-electric dreadnaughts cannot be told from the bridge. From that point they are governed much as any others. So we descend ladders and walk through dark passages until we reach the engine room. There we see no grimy sailors shoveling coal. In fact, we see no fires at all. Oil burners spread flames under the eight large boilers. All this is sheathed in metal that hides even the flames from sight. But the flames provide the steam that turns two turbines connected with two generators which drive four giant motors, each of which is connected by a long shaft to a propeller. Thirty-two thousand horses race down the propeller shafts to turn the screws.

As the big dreadnaught slides silently through the water, gun crews stand ready to toss sixteen-inch shells on enemy decks or shoot five-inch shells four miles straight up at airplanes and balloons. Yet the tremendous power that moves the big ship rests, figuratively speaking, in the hands of the two enlisted men who stand at the control panel ready to send the ship ahead faster or reverse the screws and back her away from threatening danger.



Two Sixteen-Inch Guns on the "West Virginia" Elevated for Firing at an Unseen Target beyond the Horizon

The commanding officer of an electric battleship can get quicker action than the commanding officer of an old-style battleship. Fifty thousand miles of wires carry electricity around the "West Virginia," and through them the commanding officer not only can make his commands heard, but the motors can turn the propellers from full speed ahead to full speed astern in six seconds. Of course the ship itself cannot be halted from its top speed and be made to back up in such a short time, but the propellers will be churning great quantities of water in the opposite direction in less time than you take to read this sentence.

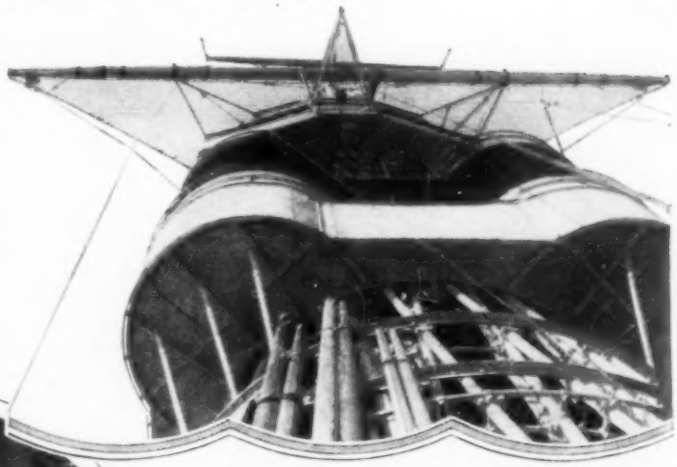
As we faced the control panel, through which this tremendous energy is governed, one of the engineering officers demonstrated the ease with which he can learn of conditions anywhere in the intricate electrical apparatus. Merely by inserting a three-pronged fork into three holes he can determine whether any of the large motors are running too hot. Here wires connect electric thermometers inside the

Above, Hoisting a Large Launch aboard a Battleship; in Circle, Three-Pronged Fork Used to Measure the Heat of the Bearings on Any Motor; Right, Seaplane Ready to Be Hoisted aboard Ship after Flight from a Catapult; the Pilot Attaches the Hook to Four Cables Leading to Points on the Plane

Left, View of the Control Panel on the U. S. S. "West Virginia," Where Two Sailors Are Actually Able to "Run a Battleship" Unaided

motors with his "motor heat panel."

But why electricity for Uncle Sam's fighting ships? The navy sought both a concentration of power and reliability—and has found them in electricity. If one of the steam turbines breaks down, an electric battleship does not lose half its power, as you might think. The electricity, in case of such a breakdown, can be spread through wires to the four motors. In fact, where, with both turbines working, the "West Virginia" has a high speed of twenty and one-half knots, it can make seventeen knots on only one turbine.



Above, Looking up the Mast of a Modern Battleship from the Main Deck; Left, on the Bridge

All the electric dreadnaughts in the battle fleet are of the same size. Each weighs 32,000 tons. The "West Virginia" is the latest. Her electrical sister ships are the "California," "Colorado," "Tennessee," "Maryland" and "New Mexico." They make up half the battle fleet. In addition to these, the two aircraft carriers "Lexington" and "Saratoga" are electrically propelled.

The future battleship will be electrically propelled, but Diesel engines will replace the steam turbines, according to naval experts. Thus smaller space may be used to house the machinery. Even the present arrangement enables builders to crowd more apparatus in much smaller space, with nearly 100 men less to operate it. Now, instead of long steam lines leading from boilers to turbines, electric wires carry the power. This permits not only savings in weight and space, but also arrangement of the main driving plants—the motors—close to the propellers.

Besides propelling these modern steel dogs of war, electricity also helps point the guns, fire them, and enables the dreadnaughts to fire over the horizon at an enemy not even the lookout in the fighting top can see. Radio, crackling through the air from observation planes catapulted from ship-deck when electricity explodes a powder charge, enables gun crews to swing the muzzles of those giant weapons and send armor-piercing shells out beyond the "bend in the ocean."

HONEYBEES' SPEED IN FLIGHT

Traveling without a load of nectar, a honeybee makes about twenty-five miles an hour, although the ordinary speed is not more than fifteen miles, tests have shown. With a full cargo of nectar, the bee can fly almost as fast as when traveling light, although it is compelled to make frequent rests on long journeys. The average load carried is about forty milligrams, or half the weight of the bee.

Composite Musical Instrument Which Gives Sounds of Piano, Mandolin, Guitar and Cello

ONE-MAN STRINGED ORCHESTRA PLAYS FOUR INSTRUMENTS

Combining four instruments in one, a music teacher, after many years of work, has made a composite instrument on which one man can present all the effects of a stringed orchestra. This one-man orchestra produces at one time the sounds of the piano, mandolin, guitar and cello. After he had finally made the instrument, the inventor was forced to spend a long period in learning to play it so that all the effects were presented simultaneously.

WEIGHT OF EARTH COMPARED TO THAT OF THE SUN

While it is impossible to place the earth on a gigantic scale and weigh it, mathematicians can closely approximate its weight by estimating the pull it exercises on the moon and other heavenly bodies. The figure arrived at is six thousand trillion tons, or six followed by twenty-one ciphers, according to English notation. This staggering figure, however, is as nothing compared with the weight of the sun. If the weight of the earth were represented by a penny, that of the sun would be approximated by 660 pounds of metal. Through the light and heat it gives off, the sun loses about 360,000,000,000 tons every day.

HUMAN EYE BEATS PHOTO CELL IN MATCHING COLORS

Contrary to general belief, many experts are of the opinion that, in spite of the wonders accomplished by the "electric eye," or photo-electric cell, it still cannot beat the human eye, particularly in matching colors. The human eye is still the most sensitive measure of color in the opinion of Irwin G. Priest, of the bureau of standards, who has applied photo-electric cells to various practical problems in industry. The human eye is the only instrument that can determine the very slight color differences in cottonseed oils, for instance, although the electric eye may do a better job in selecting colors than a human eye untrained to this work. It has been found that a trained human eye can detect with certainty differences in color of one five-thousandth of one per cent, and no instrument so far invented can compare with such a record, although far more efficient cells, of course, may be developed in the future. A fair idea of the number of colors may be obtained from a new dictionary on this subject which uses descriptive names rather than symbols, and thus reduces the almost limitless list to 7,000 shades.

COLORS ADDED TO OPEN FIRES BY USE OF CHEMICALS

Many pleasing combinations of colors may be imparted to the flames of an open fireplace or camp fire by sprinkling chemicals in crystal form on the burning wood or coal. The chemicals are contained in a metal can with a perforated top and the granules are sprinkled over the blaze frequently to continue the vivid sparkling effect.

¶A self-curing compound now is available for application to rubber, metal or leather surfaces.

COIN-IN-THE-SLOT TYPEWRITER FOR PUBLIC WRITING ROOM

Coin-in-the-slot typewriters are available for visitors to the public writing rooms of some Berlin cafes. Upon insertion of a small coin, valued at about two cents, 1,000 letters or spaces are available to the user. Should the matter to be typed exceed this length, it is only necessary to insert another coin.

REVOLVING CUTTERS ON PLOW THROW CLODS ON TOP

Working equally well in any kind of soil, a plow base with revolving cutters includes a number of features not associated with the conventional type of farm implement. The base, called a "turbulizer," has a turbinelike wheel instead of the ordinary moldboard, mounted to turn in a direction at an angle to that of the plow. This wheel is directly behind a short moldboard which deflects the soil as it comes from the share into the wheel. The latter revolves by friction with the ground, no auxiliary power being needed. The share is extremely hard on one side of the cutting edge and soft on the other so that it sharpens itself, and the nose is detachable and may be replaced when worn. It is claimed the turbulizer stirs the soil, prepares the seed bed from the bottom up, throws large clods to the surface and can be attached to plows now in use. It plows deep or shallow in sod, cornstalks or previously tilled land, and can be used with a tractor or on a horse-drawn plow.

Plow with Revolving Cutters Which Turn by Friction with Ground and Pulverize Soil

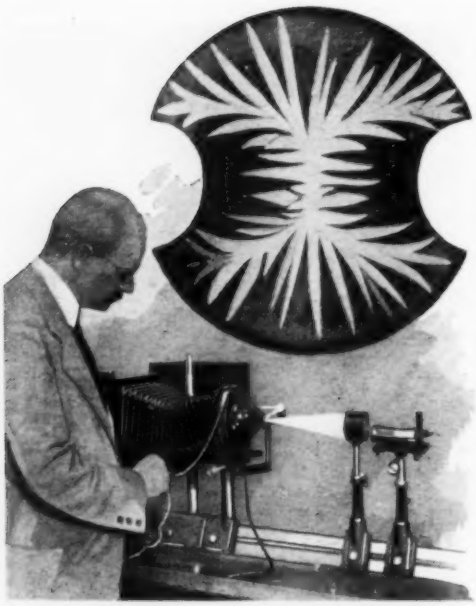
Small Screen in Theater Lounge on Which Is Shown Same Picture as Presented in Auditorium

MOVIE IS SENT THROUGH TUBE FOR PATRONS IN LOUNGE

On a miniature screen in the lounge of a Los Angeles theater, patrons may view and hear the identical talking picture being presented in the main auditorium. This enables those who wish, to retire to the lounging room without missing any of the continuity of the film. The picture is reflected from the film in the main projection room by means of a mirror and through a long tube to the glass screen, six feet wide, in the basement lounge.

EIGHTY-TON METEORITE FOUND IN AFRICAN WILDS

In the Tanganyika region of Africa, a land surveyor has found the largest meteorite yet discovered. It consists of a mass of iron and nickel weighing about eighty tons and is nearly fourteen feet long. The finder staked a mining claim to obtain legal title to his discovery which undoubtedly fell many years ago. Heretofore the meteorite found in southwest Africa in 1928 was the largest actually discovered.



Apparatus Which Makes Visible Strains in Metals, and Picture of a Metal under Stress

METAL STRESS MADE VISIBLE IN TESTING STEEL

Stresses in metals are made visible by a bench that "sees" the slightest deformation in a piece of steel under strain. When applied to model tests, reduced to size, reproducing conditions similar to those under which red-hot steel goes through the rolls, the apparatus shows in advance how various stresses are distributed. General use of the instrument, according to the inventor, gives promise of improving steel-rolling processes, thus effecting a considerable saving to the industry.

PERFUME ADDED TO GLADIOLUS AFTER YEARS OF EFFORT

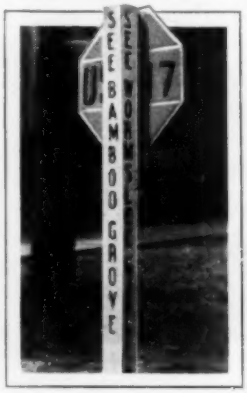
After five years of effort, fragrance has been added to the gladiolus which now has a perfume comparable to that of the gardenia. In addition to developing the sweet-smelling flower, William Henderson, an associate of Luther Burbank, has also produced new color varieties by crossing hundreds of thousands of plants and raising millions of seedlings. Many of Burbank's experiments to improve the rose also are being carried on by Mr. Henderson who has grown from seed rose bushes that attained a height of ten feet in less than eight months. Experiments are also being conducted with dahlias to improve the keeping qualities of the flower when cut, strengthen the stem and increase resistance to pests. In the fruit and vegetable kingdom almost as much has been done. Thus, stoneless plums are already grown, and an effort is being made to produce a stoneless peach. A crimson giant chard has been grown by crossing a sugar beet and Swiss chard.

BRICKS IN VARIETY OF COLORS ADD NEW HUES TO HOMES

Bricks are now being made that will take the bright colors used in tea sets, chinaware and other ceramic products, and in addition have improved sound-deadening qualities. With this product, brick homes can be built in all the colors of the rainbow, or color schemes for an entire street can be worked out to blend into a composite picture of beauty. By generating gas through brick clay a brick is produced that looks like cork and is almost as light. It holds heat, is a good noise insulator, and is given color by applying a glaze. Lavender, yellow and orange-glazed bricks already have been produced, and the color range is almost without limit.

TRAFFIC SIGN POSTS DESCRIBE ATTRACTIONS OF CITY

One enterprising municipality has utilized the posts supporting traffic signs along a through highway to inform tourists of the places of interest in the city. Plainly lettered in black down the white sides of the posts are short descriptions of the city's attractions. Further along the route, directions are given for reaching the places to which visits are suggested.



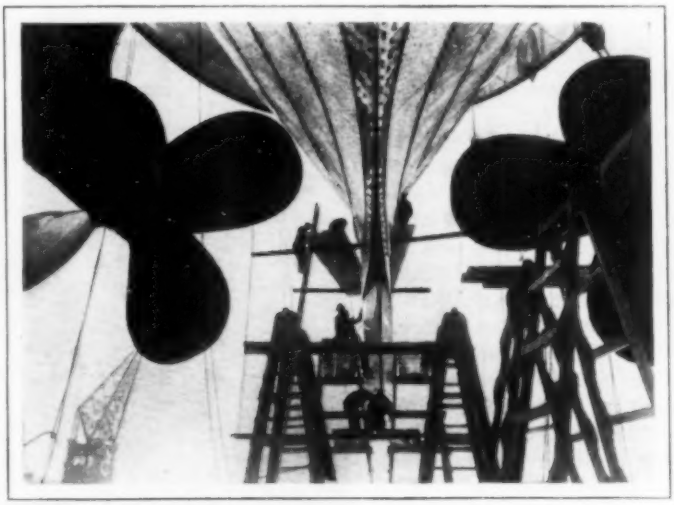
COLORED MOVIES BY HIGH-SPEED CAMERA

For producing motion pictures in natural colors, an English inventor has made a camera that takes simultaneously three photographs in the three primary colors with an exposure of only one-hundredth to one-fiftieth of a second, depending on the intensity of illumination used. The actual operation is as simple as ordinary photography, although the apparatus is somewhat involved technically. The most rapid color photography hitherto used required an exposure of two to three seconds. With the latest camera, operatic scenes in action were made recently in a Paris theater with magnesium flash powder and exposure of one-fiftieth of a second.

AWNINGS FOR AUTO WINDOWS PERMIT FREE VISION

Weatherproof awnings for the automobile windows, mounted on tubular rods, are easily adjusted. They are so constructed that they allow unobstructed vision, yet provide sun and storm protection for the occupants of the car.

Tilting Awnings for Automobile Windows Which Afford Protection without Obscuring Vision



Unusual View of the Two Giant Propellers of the "Majestic"; the Picture Was Made While the Vessel Was in Drydock

BIG PROPELLERS OF "MAJESTIC" LOOK LIKE ELECTRIC FANS

When the giant transatlantic liner "Majestic" was placed in floating drydock at Southampton, England, recently for overhauling, an unusual view of its huge propellers was obtained. The picture was taken from beneath the keel, and shows the propellers looming above like two mammoth electric fans, dwarfing the size of workmen near by.

GIANT ICE CRYSTALS FORMED ONLY ONCE BY NATURE

Giant ice crystals, up to eighteen inches across, are found at only one place in the world, in the famous Kungur ice caves of the Ural mountains. Russian scientists recently returned from these caverns with striking photographs of the fantastic structures taken by water in these remote grottoes. Snowflakes are seen under the microscope as delicate six-pointed crystals, and hailstones, on rare occasions, have been found to consist of crystals visible without magnification, but the huge cave crystals are more beautiful than either. They are hollow and six-angled, with a curious spiral geometry, showing the intricate effects of window-pane frost projected into three dimensions. The ice is deposited like hoarfrost by the cooling of moist air as it passes outward through the caves.

SMOKE EATERS

THE "Cervantes," a Spanish tramp, backed out of her slip along the East river and swung her bow downstream, outward bound on her last voyage.

A vigilante on shore, one of New York's marine firemen, heaved a sigh at the thought of strange shores lapped by tropic seas—the natural sentiment of sailors watching a vessel clear the harbor.

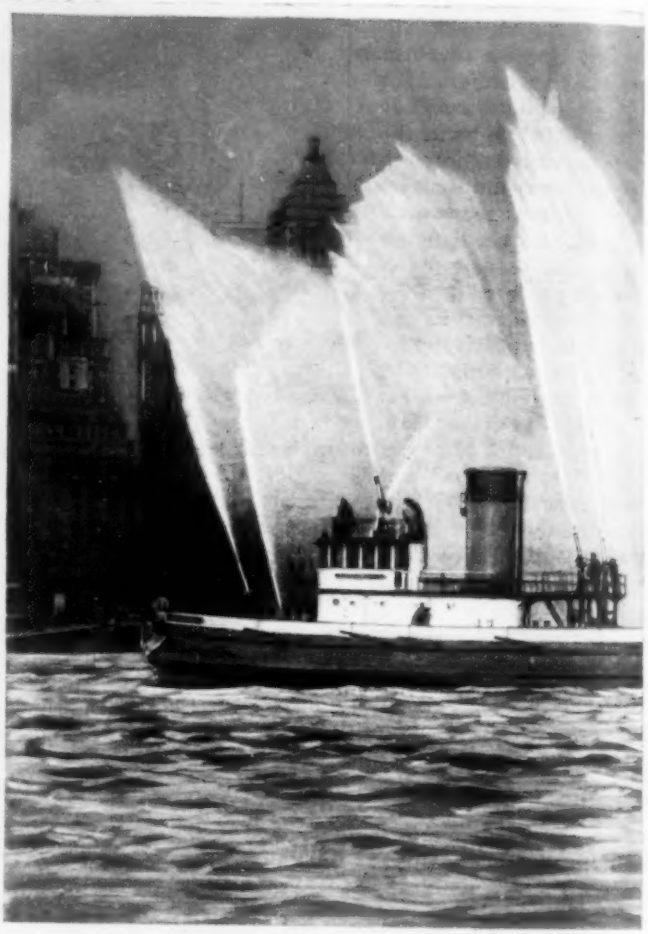
She crept down the bay and came abreast Owl's Head. Puff! A sooty cloud rose forward of amidships. Then the stern hatches belched smoke; also, the port holes and ventilators. The fireboats had steam up. The crews scurried aboard and shoved off just as black plumes came from the "Cervantes." She carried a cargo of case and barrel oil, and an Indian crew.

A six-mile tide drove her toward a government hospital ship anchored in the Narrows. Boom—boom! Barrel after barrel exploded and burned. Oil poured out on the water. The hospital ship lay in grave danger.

The fireboats hove to, playing streams of water on the tramp, saving members of the crew, beating back the dancing flames. With a thud and thunder the oil containers gave way. For fifty-two days and nights she burned, the most dogged and cranky blaze that ever cursed a ship.

After defying the fireboat fleet for almost two months, she lay there charred and ghostly, reeking with the stench of dead ships. Wreckers towed her away and sent her bones to the bottom. The "Cervantes" remains a haunting nightmare to all who remember the terror of her black hulk lighting the harbor for weeks, but she was, perhaps, not so ghastly as the blasts which scuttled the North German Lloyd greyhound "Muenchen" as she lay at her North river slip, just arrived from overseas.

Just before the explosion, the fireboats came alongside. They began pouring streams of water into the after hatch, where dense smoke issued from a cargo



A New York Harbor Fireboat in Action; This Is One of Many Boats Protecting a 578-Mile Waterfront Valued at Billions of Dollars

....on the WATER

Boats Such as This Can Pump Up to 10,000 Gallons of Water a Minute; Note the Tower from Which Water Is Thrown Many Hundred Feet

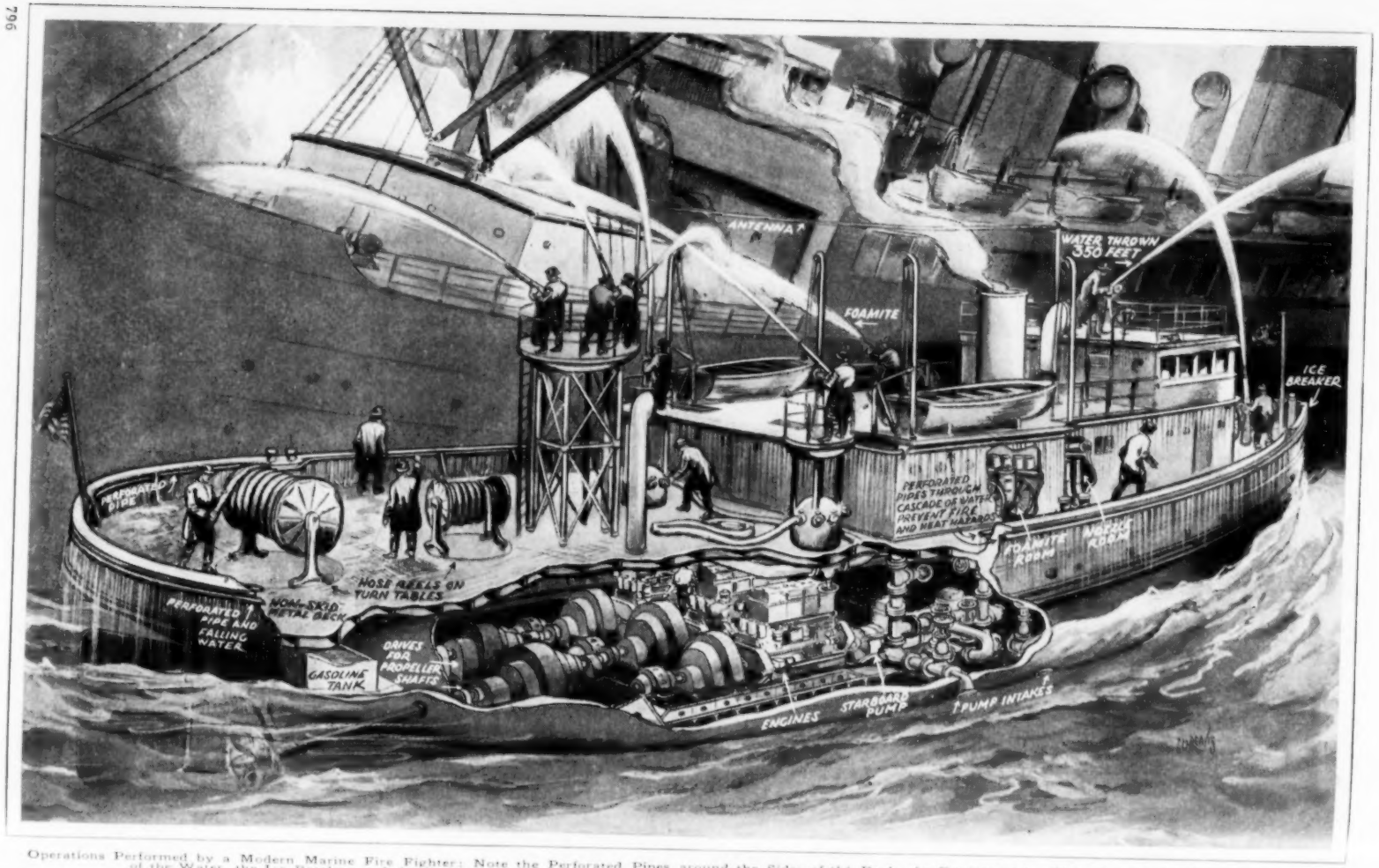
of chemicals. First she was rocked by a single explosion. A series of blasts followed in five minutes, blew a jagged opening in the stern and forced such a depression in the water that the fireboat "Willett," standing hard by, was swamped under a veritable tidal wave, a wall of water six feet over the main deck sweeping men and apparatus into the river. The "Willett's" pilot was drowned, and she lost her anchor and hose reels weighing several tons each.

Duty carries the marine firemen into such danger. The organization in New York harbor, the largest in the world, protects a 578-mile waterfront whose property value runs into billions. All structures approximately within 400 feet of the shore are under protection of the marine firemen.

The fleet of ten fireboats is manned by 300 men working on the two-platoon system. The day shift works nine hours and the night shift fifteen hours, averaging twelve hours a day for the year. The boats are strategically located in various parts of the harbor.

In addition to piers, warehouses and other waterfront properties, the fireboats must protect about 20,000 large vessels entering and clearing the port every year, besides countless small pleasure craft, houseboats and motorboats; lighters, barges and excursion boats, carrying many thousands of passengers.

About fifteen men compose the crew of each fireboat. The members are captain, lieutenants, pilots, four engineers, four stokers and six firemen. Alarms are received in the same way as on land. Two fireboats are usually dispatched in answer to every alarm. The system has recently been augmented by a radiophone installation which enables the deputy chief at land headquarters to send instructions direct to the captain of the fireboat. In the course of a year, the fireboat fleet answers some 3,000 alarms, at an average cost of $150 each.



Operations Performed by a Modern Marine Fire Fighter: Note the Perforated Pipes around the Sides of the Deck, the Equipment for Throwing Chemicals on the Surface of the Water, the Ice Breaker, and the Radio Antenna over Which Alarms and Orders Are Received. Such a Boat as This Costs Over $500,000

Operations Performed by a Modern Marine Fire Fighter: Note the Perforated Pipes around the Sides of the Deck, the Equipment for Throwing Chemicals on the Surface of the Water, the Ice Breaker, and the Radio Antenna over Which Alarms and Orders Are Received. Such a Boat as This Costs Over $500,000

The modern fireboat is a steel-hulled vessel built especially for her particular work. Although she has bunks for the crew, she does not have a galley, since she rarely stays away from shore more than a day. Pumps and propelling machinery receive careful attention. The capacity of the various boats in the New York fire fleet ranges from 5,000 to 10,000 gallons a minute.

The heat-producing fuels used at present are coal and crude oil, although a fireboat now under construction will employ a new type of motive power. Concerning this gas-electric installation, Deputy Chief John J. McElligott, in command of the marine division, exclaimed: "She'll be the best thing afloat!"

General View of a Modern Fireboat; in the Background on Shore Is a Water Tower Capable of Delivering 9,000 Gallons of Water a Minute

From water tower to keel her construction will be metal. Her guaranteed speed will be eighteen miles an hour, and her pipes will belch 16,000 gallons per minute at 150 pounds' pressure. Fully equipped her cost will approximate $600,000.

In her hold this new fireboat will carry two tons of "foamite," a substance which bubbles on the water's surface and serves to quench burning oil. By a system of reversible fans, foul air and smoke can be forced from all parts of the vessel, and a supply of fresh air sucked in every two minutes. An auxiliary power boat, with a pump capacity of 150 gallons a minute, is designed for fighting blazes under piers.

The hazards of marine fires are greatly increased by the fact that no two are alike. The size and construction of a vessel, and the type of cargo, determine, in a large measure, what species of fire may be expected. Successfully to fight ship blazes, fireboat officers must have intuition as well as a technical knowledge of ships. Many are recruited from the ranks of seafaring men, with experience aboard all types of merchant-marine ships. Since the fire fleet is operated jointly under municipal and federal regulations, the crews are exposed to the strictest surveillance. All pilots and marine engineers must pass examinations before they receive licenses authorizing them to perform duties as such in the public waterways of the harbor.

The element of uncertainty enters into most ship fires. An example of what may be expected is found in this story related by Deputy Chief McElligott, who discovered a new perversity in marine blazes when the British tanker "Black Sea," carrying a cargo of bulk gas and naphtha, burned off the "oil coast" of New Jersey.

"In the midst of discharging her cargo," said McElligott, "the 'Black Sea' exploded in Kill Von Kull. That spot was dangerous to shipping, so we towed her to the flats near Robbins Reef lighthouse and turned on the pipes full blast. Having responded on the 'John Purroy Mitchel,' I ordered her nose turned into the tide

Fire-Department Officials aboard a Fireboat Where Radio Apparatus Is Undergoing Tests; Alarms and Instructions Are Now Received by Radio

to keep the 'Black Sea' from drifting, if possible.

"She blazed all night, but we kept washing her down. Suddenly, the entire bay lighted up as oil began spurting out of her seams. A weird blinding flash burst out of a rivet hole on the starboard side.

"With all pipes operating, we retreated and tried to beat back the flames dancing across the water.

"It was ebb tide; the gasoline began flowing toward the Staten Island piers, where ships and warehouses are filled with valuable merchandise.

"By hard labor we managed to confine the fire near the vessel. The 'Black Sea' was colossal, fully 600 feet long, six tanks in her hull—one of the largest tankers afloat. Remembering the old 'Cervantes,' we had visions of another fifty-two-day battle. Although we kept the fire from traveling with the tide, it seemed to gain headway on the ship.

"What happened inside that vessel I don't know, but suddenly the flames became less intense and before our unbelieving eyes, they soon disappeared entirely. Eight fireboats had been playing about fifty pipes on her. Well, we wetted her down for another half hour, and then I ordered all streams shut down. We waited fifteen minutes. I boarded the 'Black Sea,' examined her fore and aft, and recovered the bodies of three members of the crew who had failed to get away.

"Would you believe it? Eighty per cent of her inflammable cargo was ultimately salvaged. Why it hadn't burned or exploded is another mystery of ship fires which nobody understands."

AN ELECTRICAL EXPLORER

Electrical exploration of the composition of the earth is the latest aid in tunnel making and dam building. Bedrock, for instance, can be found 100 feet or more underground by laying a few electric wires on the surface. The electric feeler current substitutes for the usual exploring drill, but instead of bringing back samples of the material it penetrates, the current sends messages telling how much resistance it encounters.

FLOODLIGHT ON TOP OF TRUCK FOR AIR MANEUVERS

Mounted on a truck, a 30,000,000-candlepower floodlight furnished illumination for the spring maneuvers at Mitchell Field, on Long Island, in which several hundred airplanes participated. The truck carrying the powerful beacon contained a compact portable power plant, which set ablaze the entire 400-acre airport, supplying electricity for the tented city during the practice.

Powerful Floodlight Mounted on Truck to Illuminate Army-Plane Maneuvers

FORTY MILLION MILES AN HOUR APPARENT SPEED OF STARS

Eleven thousand miles a second, or nearly 40,000,000 miles an hour, is the new record "apparent" velocity detected in the reddened light from a distant universe of stars viewed through the world's largest telescope on Mount Wilson, California. The faint nebula found to be receding from the earth at this speed is so distant that light requires 120,000,000 years to reach the earth. The research result is expected to have a bearing on Professor Einstein's conception of the universe. In photographing the spectrum of the nebula with the telescope, it was observed the spectrum lines were shifted to the red in such a way that a rushing away at 11,000 miles a second would be necessary to produce the effect. This is sixty per cent greater than any apparent velocity so far observed, but astronomers do not actually believe the cluster of stars is receding at such a rate. They see the true explanation in the curvature of space, as postulated by Professor Einstein. Therefore very distant objects might give the effect of great speed, not because they are moving so fast, but because they are so far away that space is given a chance to produce its effects.

WIRES TIGHTENED OR BROKEN WITH A HAND TWISTER

For tightening or breaking wires, a simple hand-operated tool gives a powerful leverage that easily twists or breaks off hoop bands or wires. The tool has three prongs, the middle one shorter than the outer ones, and in the handle is an opening for a rod by which increased leverage can be obtained if needed. The tightener is handy for farmers and others.

More than 500 toy factories in the United States have a yearly production valued at nearly $100,000,000.

Apparatus Which Makes Minute Measurements of the Head; It Is Used to Diagnose Character

MEASURE OF HEAD DIMENSIONS SHOWS WEAK POINTS

In an endeavor to develop character, a Berlin institution is taking careful measurements of the head and various other parts of the body. The examination and measurements are said to reveal the weak and strong points of character, and the student then sets about strengthening his weak points by a course of memory and concentration exercises. These exercises, it is claimed, result in greater confidence on the part of the subject.

LIGHTED MAP HOLDER FOR AUTO ON STEERING COLUMN

Accommodating maps, service charts or other information desirable in driving, a holder that attaches to the steering column of the auto is fitted with an electric light and reflector so the information can be read easily at night. It is a convenient rest for highway routings which may be folded and attached to it so directions can be seen while driving.

Revolving Disk Map of Europe; the Slots Reveal the Principal Facts about Country at Which Indicator Points

REVOLVING DISK MAP DISPLAYS ALL EUROPE AT A GLANCE

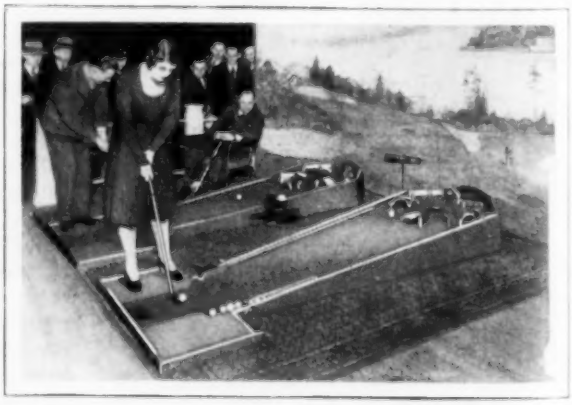
All the principal facts about any one of thirty-four European countries are shown at a glance on a revolving cardboard-disk map which enables the information seeker to assimilate the figures and names quickly. The map consists of a small disk containing slots superimposed on a larger one, around the edges of which are the names of the countries. Upon the upper disk is a map of Europe, with the countries indexed by numbers, and a pointer. When the pointer is set opposite the name of a country on the larger disk about which information is wanted, the openings in the upper circle display the location of the country on the indexed map, the form of government, the time in that country, when the Greenwich observatory clock registers noon, and the national colors. It also gives the name and length of the principal river, the name and height of the highest mountain, the name and population of the capital city, the population of the country, the area in square miles and the population per square mile.

BIRDS THAT FLY OCEAN

There have been several known instances of birds flying across the Atlantic ocean. A lapwing ringed in England was picked up in Newfoundland, and probably crossed without resting. Many birds, however, take advantage of passing steamers, lighting on the decks for rest and showing little fear of passengers. Pigeons, owls, linnets and chaffinches are among birds seen in mid-ocean, apparently crossing the sea. Some migratory birds fly even greater distances.

COIN-IN-THE-SLOT GOLF OFFERS NINE HOLES AND HAZARDS

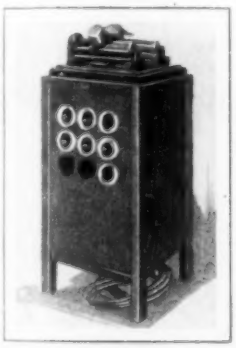
Nine holes of golf, each with a different hazard, are offered in a coin-in-the-slot indoor course that is only nine feet long and three feet wide. The ball is driven up an incline covered with heavy felt. The cast-aluminum hazards in various shapes are set about the edge of a circular turntable at the head of the frame, the cup being in the center. After sinking a putt, the player presses a pedal to bring the next hazard in line. When the balls fall into the cup, they roll back to the player under the runway, the nine being released for play when he inserts a coin in a mechanism. For home use, the courses can be obtained without the latter.



Coin-in-Slot Putting Game; Nine Hazards on a Revolving Stand Offer Equivalent of Nine Holes of Golf

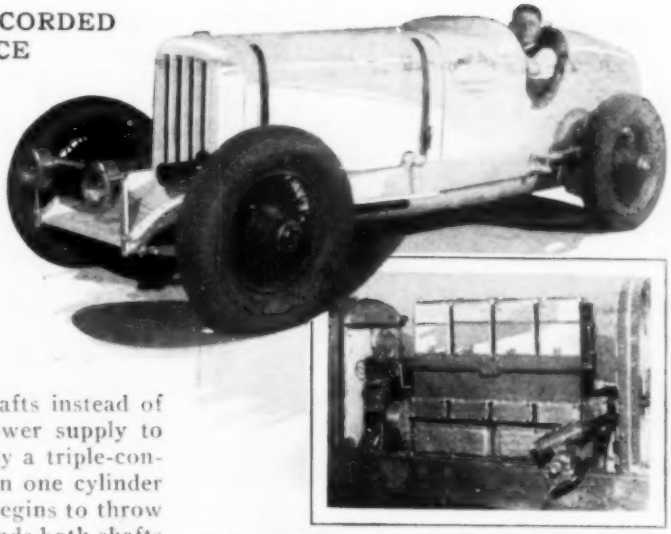
TALK ON PHONE RECORDED FOR REFERENCE

Both ends of telephone conversations now may be recorded for future reference with a machine known as a "telecord," which operates on principles similar to those of the apparatus on which letters are dictated, a stylus engraving the voice impression on a wax cylinder. The telephone recorder has two shafts instead of one, however, with the power supply to the two motors operated by a triple-contact mercury switch. When one cylinder is nearly full, the carriage begins to throw this switch. For a few seconds both shafts turn, so that both cylinders are recording, then the motor of the first breaks contact and the second continues. The first cylinder then can be removed and a fresh one inserted, ready to take up the task when the second is filled, so that long conversations can be recorded without interruption. The telecord does not record acoustically, but electrically. The cylinders are transcribed with a regular commercial machine for this purpose. The instrument may be connected to a switchboard, so it starts or stops as the line goes in and out of use, or it may be operated by a foot switch or manual control to record important parts of a conversation.



DIESEL ENGINE IN RACING CAR DEVELOPS HIGH SPEED

If the builder's plans are carried out, the world's first racing car equipped with a Diesel engine will compete this year in the Indianapolis auto races. The Diesel-powered car will stand forth like a giant among the other entries, for the snow-white machine is seventeen feet long. The designers do not depend so much on the car's speed as on its endurance. Its tank holds forty-seven gallons of crude oil, and the builders expect it to travel twenty-five miles to the gallon at a speed of 100 miles an hour. As a result, barring engine or tire failure, the mammoth car can make a steady non-stop run, because it will not be compelled to halt for refueling like the faster cars. The racing giant weighs about 2,800 pounds, has four cylinders and a piston displacement of about 366 cubic inches. It has no ignition system, the heat of compression being utilized to fire the fuel.



Racing Car Equipped with Diesel Engine, and Power Plant Which Burns Crude Oil

FISH LURE ACTS LIKE LIVE BUG BY FLAPPING ITS WINGS

To attract the more cautious members of the finny tribe, a fish lure that imitates a live bug floundering on the surface of the water now is being offered. The lure is of metal with bright wings, the colors and the motion serving to attract immediate attention. It can be used for casting, trolling or dipping, and will not tangle or twist the line.

KITE WITH RADIO TRANSMITTER FOR DIRECTION FINDING

Kite Equipped with a Radio Transmitter, Which Is Used in England in Direction-Finding Tests

Kites carrying wireless transmitters, and weighing little more than a pound, are being used at a radio-research station in England in connection with direction-finding tests. The kites are intended to reproduce the erratic conditions met at night and carry about 100 feet of aerial, eight dry cells and a tube as the transmitter units. They ascend 500 feet, and the transmitter has a range of about half a mile. This method of direction finding has proved the most accurate yet devised.

HUB LIGHTS FOR AUTO WHEELS ADD TO SAFETY

To make night driving safer, hub lights now are being provided for auto wheels. Two bulbs are mounted within each hub cap, assuring a bright red or green revolving light that can be seen for a great distance, giving other drivers a mark for clearance in passing, and helping to prevent the danger of sideswiping.

AERIAL FIFTY MILES IN LENGTH FOR GRAND CANYON RADIO

Radio penetrates to the bottom of the mile-deep Grand canyon over an aerial fifty-two miles long. The superintendent of the Supai Indian reservation is connected by a private telephone line with the Grand canyon station fifty-two miles distant, and uses the telephone wire as his radio aerial, it being the only one that seems to work satisfactorily in the bottom of the canyon. Recently while receiving a broadcast, he telephoned a forest-service lookout station sixteen miles distant, and the lookout heard the program when the telephone transmitter was placed near the radio speaker, the same wire that served as aerial carrying the audible program back over its length to the lookout.

ELECTRIC EYE SERVES WATER FOR DRINKING FOUNTAIN

Drinking fountains now can be operated by an electric eye, or photo-electric cell, which turns on the water when a thirsty person approaches, and turns it off when he departs. The eye also operates the machinery of an electric cooler which ices the drink. An electric light is suspended in front of the cooler above a wooden platform with a hole in the center under which the eye is placed. When anyone steps on the platform, the rays of light to the cell from the bulb are interrupted, causing the cell to stimulate an amplifying tube which opens a relay switch. A magnetic valve, affected by the relay, turns on the water, and an electric refrigerator unit to cool the spray also is placed in operation. When the person steps from the platform, the process is reversed and the apparatus stops.

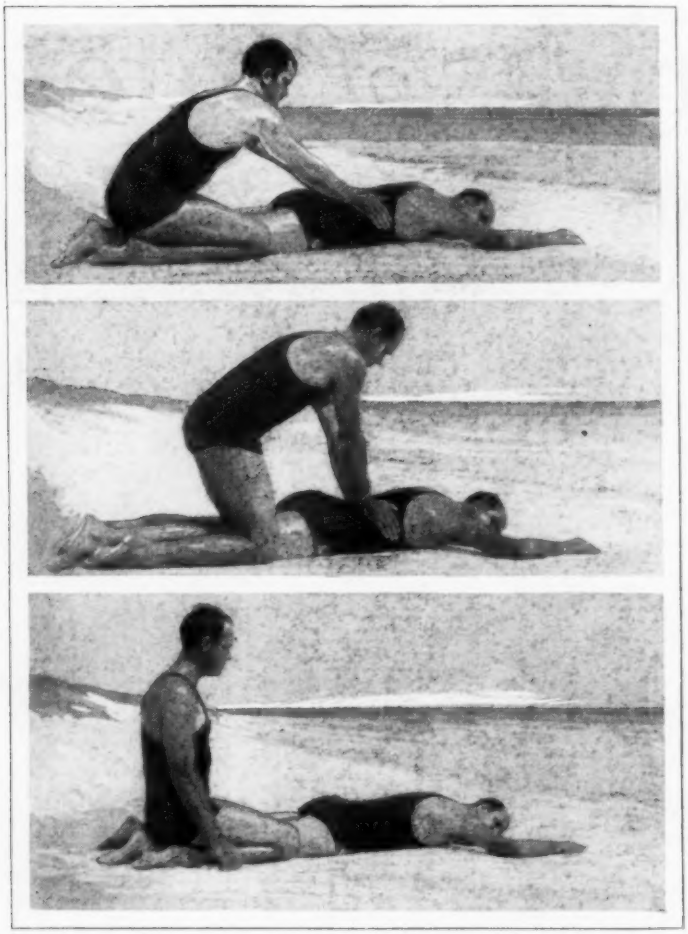
The Tricks of Life Saving

A GROUP of boys are swimming when a cry of distress terrifies the group. One lad is seized with cramps and threshes the water desperately. He sinks—once, twice, three times—and fails to come up. Frantically two or three older boys dive for the victim. Finally somebody locates him and drags him out of the river. He is rolled over a log. After much rolling and discharge of "lung water" he is revived and taken home.

All of which makes a familiar type of rescue story during the summer season. But it's entirely fanciful we are told, emphatically, by D. Melville Carr, nationally known life-saver with 250 rescues to his credit. For among the popular fallacies in regard to drowning persons none surpasses the two listed above—that if a person sinks for the third time he will not come up, and that rolling a half-drowned person over a log or barrel removes the water from his lungs.

Life-Saving Tricks That a Would-Be Rescuer Should Know; Top, Breaking Front Strangle-Hold; Center, the "Head Carry"; and, Below, the "Hair Carry"

"The third time down," explains Mr. Carr, "has nothing to do with a man's chances of being saved. The truth is, a drowning man struggles until he is exhausted. He may come up three times or ten times, or not at all. The only reason he goes down in the first place is because he raises his hands high above his head instead of leisurely threshing the water with them as he should, meantime kicking his feet in an endeavor to tread water. In fact, cases have come to my attention where men have gone



The Three Proper Positions in Inducing Artificial Respiration; Note Position of Victim, with Nose and Mouth Free for Breathing

down more than a dozen times and remained submerged fully half an hour and yet have been revived."

Mr. Carr goes on to point out that the well-known method of rolling a victim over a log or barrel is absurdly useless. In certain uninformed quarters this practice is supposed to remove water from the drowning person's lungs, whereas a great body of medical men today strongly doubt that any water whatever enters the lungs as a suffocating factor. The water commonly supposed to be lung water really comes from the stomach and would not hurt the victim if allowed to remain there, except, perhaps, to cause slight nausea. As a matter of fact, Mr. Carr says, there is no known method of getting water out of the lungs even if any were there.

Another popular fallacy about attempts to save people from drowning is that the victim ought to be hit on the jaw so as to make him helpless. Nothing could be farther from the truth, Mr. Carr says. If the drowning person is so weak that such a blow would render him unconscious then he already is too helpless to make the blow necessary. If, on the other hand, the victim is struggling so violently as to make it impossible to subdue him or grasp him with safety, the only sensible thing to do is to wait for the drowning man to exhaust himself. Breaking holds by inflicting pain is also impractical. A man fighting desperately for his life will not be affected by such methods.

But if you're endeavoring to rescue a drowning person, does he really try to grab you in a death grip? Not at all, explains Mr. Carr. The only reason he makes vicious lunges at you is that he's trying desperately to climb on you in order to get his head out of water.

Of course, occasionally there are individuals who are so excitable that their treatment demands special measures. Granted that they have succeeded in getting a strangle-hold on their rescuer, they will try to maintain it. In such an emergency all the rescuer needs is a knowledge of the best "breaks" for the various strangle-holds plus a little common sense. A wise thing for him to do is to stop treading water. Whereupon the victim, finding he is no longer being supported, will naturally loosen any grip he may have been able to maintain.

"No matter how strong a swimmer a man happens to be, if he expects to be prepared to save a life in the water he

must undergo a stiff period of training," says Mr. Carr. "In a word, this involves constant practice in adapting his swimming strokes to those needed in a rescue—namely, swimming on the back without the hands, while utilizing the kick only, or swimming on one side while employing the kick and underarm only.

"The fundamentals of water safety may be listed as follows: Don't swim alone—this bad habit is the major contributing factor to drowning disasters; don't swim too far from shore—even the great champion short-distance and marathon swimmers never venture far from shore without a boat alongside; don't swim too soon after eating, and don't dive in shallow water.

"A popular misconception is that women cause their rescuers far more trouble than men due to their temperamental make-up. My own experience has been that women, if anything, are easier to save. This is because of their lighter weight and less strength and the fact that their longer hair makes the 'hair-carry' easier to accomplish.

"When a rescuer is called upon to break two persons apart who are clinging together in a front strangle-hold, he should swim to a point directly behind one of them, preferably the weaker swimmer, and place his hands on the chin. Pushing down with forearms in order to sink the victims, the rescuer should then raise one foot over the locked arms, placing the foot against the chest below the throat of the subject facing him, straighten out his leg, push down and pull up, thereby separating the two. Avoid kicking under all conditions."

Merry-Go-Round Cafeteria with an Inner Circular Counter Which Revolves, Carrying Trays of Food Constantly Past the Customers

MERRY-GO-ROUND LUNCH ROOM HAS REVOLVING COUNTER

Merry-go-round lunch rooms, or trayless cafeterias, are taking a whirl for public favor on the Pacific coast. These self-service restaurants have circular counters with an inside portion of the counter which is constantly revolved at slow speed by an electric motor. Glass-inclosed cabinets of cold foods constantly pass before the patrons on this moving belt, the customer being given plenty of time to make a selection and extract a dish from a cabinet as the counter moves by.

FIRE ALARM WIRED TO PHONE OPERATES AUTOMATICALLY

Turning in an alarm automatically when room temperature reaches a predetermined degree, a fire alarm for attachment to a telephone circuit is now available. It is intended particularly for hotel rooms in which a blaze may be started by a carelessly tossed match as a guest is leaving. When the room temperature rises, the alarm device closes the telephone circuit, just as when the receiver is lifted from the hook, thus warning the hotel operator that something is amiss in the room before the fire gains headway. No adjustment is required after the alarm has operated, as it automatically returns to an open circuit when the temperature is lowered. In homes the alarm can be attached to the door-bell circuit, causing the bell to ring continuously if the room becomes hot, and it can also be connected to annunciator systems in hotels, or sprinkler systems in factories.

DEEP-SEA DIVING MASK FILLED WITH SYNTHETIC AIR

Diving Mask for Deep-Sea Work Filled with Synthetic Air to Decrease Time for Decompression

Possibility of recovering sunken treasure that has lain for years at the bottom of the ocean has been increased recently by the invention of a special diving mask for deep-sea work. This mask is supplied with a synthetic atmosphere of helium and oxygen, which is said to enable divers to decrease the time required for decompression on coming to the surface by at least two-thirds. Among the treasures which divers hope eventually to recover are the $5,000,000 in gold that went down with the "Egypt" off the coast of France, and $1,000,000 in gold and silver that sunk with a liner off the Virginia capes.

WIDTH OF OCEAN IS MEASURED BY LONGEST TAPELINE

Stretching from Newfoundland to the Azores, a tapeline 1,264 miles long was reeled out recently from a cable steamer to obtain an accurate measure of the distance traveled, and hence an accurate estimate of the cable length. The tapeline was a fine steel piano wire which was reeled out constantly although it had no connection with the telegraph cable which was passing over the stern sheaves at the same time. The occasion for the measurement was the laying of a new type of cable which, because of its peculiar construction, had to be laid as close as possible to the 1,341 nautical miles specified by engineers. Any greater length would have upset the calculations of these experts, and would have made operation at the desired message speed quite problematical. The length of the cable had been predetermined by the contour of the sea bottom over the route. Because the distance along the sea floor was greater than the distance traversed by the ship, sufficient slack was payed out to permit the cable to rest on the bottom. With the steel wire giving the distance traveled, and the contour of the sea floor known, it was relatively simple to figure the amount of slack required for each mile. To keep the wire taut for accurate measurements, a pull of from thirty-six to forty pounds was maintained on the wire as it was payed out by a revolving arm with a spool through which it was pulled.

PENCIL SHARPENER FOR DESK LOOKS LIKE INKWELL

Resembling an ordinary inkwell, a pencil sharpener for the desk can be operated without soiling either hands or desk with lead dust and shavings. The sharpener consists of a metal receptacle into which the circular top containing the knife fits. The blade is in the center of the cap in a vertical position, and the pencil is inserted in a hole in the upper part of the device and turned a few times, the shavings falling into the base.

Pencil Sharpener for the Office Desk with a Receptacle for Shavings and Lead Dust

With the Balloon Busters

By CORLEY McDARMENT

"SHOOT that balloon down!"

This order was shouted to a group of tense-nerved pilots on an airdrome one day in France during the world war.

"Get that balloon or the whole division will be wiped out," explained a high staff officer. "The observer in that balloon is making every enemy shell strike home. Go get him!"

The fighting airmen, many of them aces, looked knowingly at each other and, with silent hand waves of farewell, moved to obey the order. They knew that death rode the winds at a furious pace in the vicinity of observation balloons, or "sacred cows" as they were usually called. Far more dangerous than enemy airplanes were these captive balloons. Several batteries of anti-aircraft artillery filled the sky with shrieking shrapnel, and the man who could slip through this barrage of hot steel was lucky. Balloon aces were very scarce during the war, for those intrepid flyers who went in for balloon "busting" lived short and exciting lives.

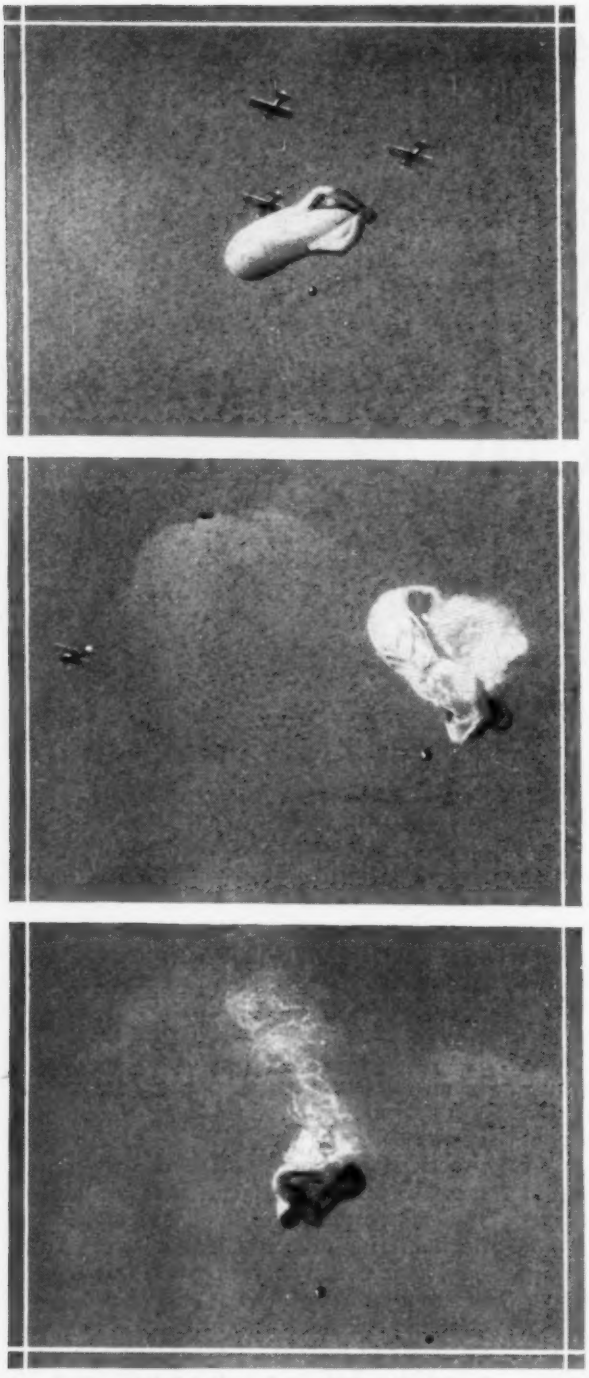
Even on peace-time balloon-bursting maneuvers, death hovers in the vicinity of the big gas bags. By holding a dive too long, a pilot may fly into the bag, or he may scrape it and tangle a wing, or it may explode in his face and surround him with flaming gas.

Hydrogen is used in the captive balloons on maneuvers, for it is presumed that an enemy would have to use this because the United States owns the only large source of helium gas known in the world. And hydrogen is explosive. Tracer bullets carrying a streak of fire are shot into the balloons and allowed to explode them.

The fast pursuit planes gain a great altitude above the balloon. Then the pilot sticks the nose straight down and lets the slim white marker on the air-speed indicator climb against the peg. When close to the balloon, small bombs are released or machine-gun fire is opened up, and the pilot pulls carefully out of the dive just at the right time and place. The trick is not easy to do.

Most pilots find themselves pulling out of the dive too early. It takes the most practiced judgment to tell the right moment to pull out. No censure is attached to a pilot's pulling off too quickly, but if he holds his dive too long and fouls the bag, he is usually soon beyond any worldly censure.

The very fastest airplanes are used against the balloons because in the next war these balloons will be protected by far more efficient anti-aircraft guns. The man who gets balloons in future wars must travel so fast that he can scarcely be seen.



Three Planes Attacking Observation Balloon; Plane Disappearing after Bursting Balloon; Balloon Falling in Flames

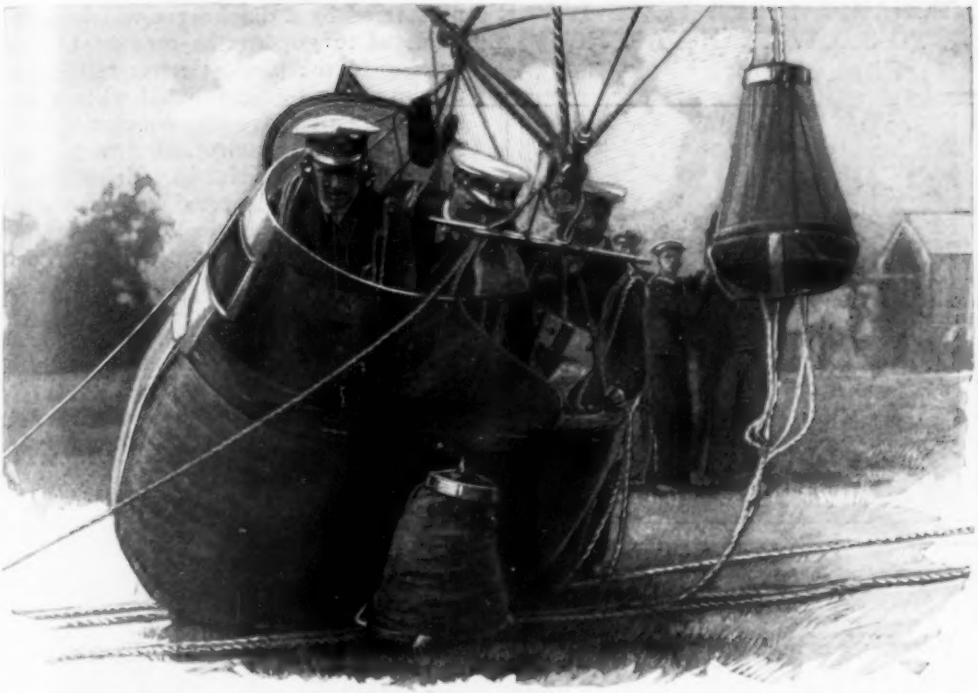
It would seem that an aviator could get off at a distance and shoot at one of these big "sausages" with machine guns until it gets hit. But the machine guns do not carry far enough to be out of the anti-aircraft range, and they make too small a target with the whole sky as a background. Also, it is only the tracer bullets which will set the hydrogen on fire, and they burn out within a few hundred yards and then become as cold as ordinary shot. An aviator must get right down against a balloon and empty his tracers into it for sure effect.

Great pyrotechnic displays were made around a balloon when attacked during the war. The enemy had peculiar flaming bombs which hung in the air. There were "flaming onions" and other queer things sent up after the attacking planes. One object shot into the air was somewhat like the chain shot of Civil war days except that the links in the chain were balls of fire. These long snakelike objects were sent winding up in the vicinity of the observation balloons in the hope that they would wrap around the attacking airplane. These strange missiles used to amuse the attacking airmen rather than create fear. The thing most dreaded was machine-gun and rifle fire from the ground.

Besides the tracer-bullet method of destroying balloons, a more spectacular way has been tried several times with varied success. This is the bombing method.

Small bombs, which burst on slightest contact and start a fire, are loaded beneath the wings of the pursuit planes and at the bottom of the dive and just above the balloon, the "eggs" are "laid." If they hit, the balloon is a goner. If the bombs go on to the ground, they create plenty of confusion there with the crew at the balloon winch.

It is hard for most aviators to get in close enough to a balloon or airship to



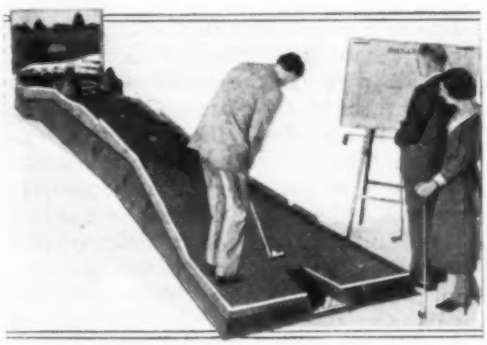
Close-Up of a Balloon Basket and the Old-Fashioned Parachutes in Containers; Observers from Balloons Directed Artillery Fire with Deadly Effect during the World War

open effective fire. This is because the craft looms so large that the pilot is deceived as to its distance. At 200 yards, a pilot usually feels that he is about fifty feet from a balloon or airship and he instinctively pulls away.

One new method of balloon bursting which appears to hold some promise is that in which fifty-caliber machine-gun bullets are used. These large bullets are capable of carrying big charges of incendiary material. The only difficulty with the heavy-caliber bullets is the recoil. A small speedy pursuit airplane trembles from hub to fins when the fifty-caliber guns are firing through the propeller. Pilots feel as if they had been through a whipping machine when they land after firing these big aerial "Berthas."

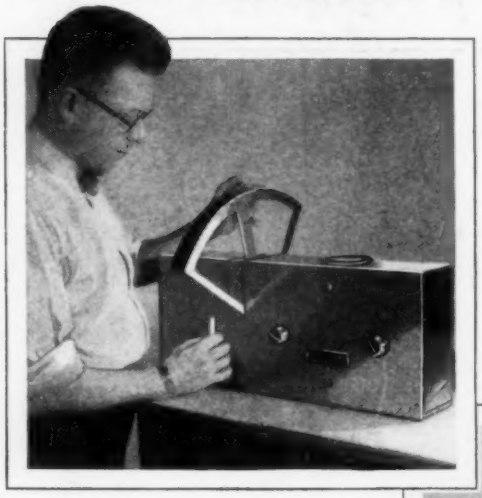
COIN-IN-SLOT GOLF GAME GIVES INDOOR PUTTING PRACTICE

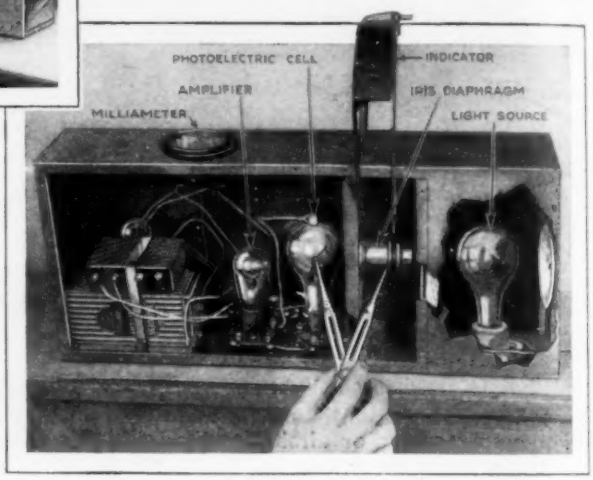
Indoor putting practice, and some of the thrills of playing a full-size course, are offered in a coin-in-the-slot golf game recently introduced. The course consists of a fairway, some twenty feet long, with a circular green at one end. Sections of the fairway are set at various angles, thus creating several hazards to be overcome in reaching the cup. The hazards are marked with numbers that decrease as the ball nears the cup, these numbers being used in scoring each player's shots. Balls are delivered when a coin is deposited in a slot, and are returned to the player when a foot plunger near the tee is pressed, the balls dropping into a section beneath green and fairway after being played.



Coin-In-Slot Golf Game Which Offers Indoor Putting Practice and Some of Thrills of Real Game

MECHANICAL EYE TESTS PAPER TO SHOW TRANSPARENCY





Above, Testing Transparency of Paper Sample; Right, Interior View with Dividers Showing Iris and Retina

Paper, glass and textiles can be accurately tested to determine relative degrees of opacity and transparency by inserting samples in a mechanical eye that in many respects corresponds in its various parts to similar parts and functions of the human eye. The motivating unit in the instrument, known as an "opacity-transparency tester," is a photo-electric cell, or electric eye, corresponding to the retina of the human eye. The function of the human iris is performed by a diaphragm which can be adjusted to govern the amount of light passing to the photo-electric cell just as the human iris adjusts itself when a person enters a dark room. An electric lamp serves as a light source. Between it and the diaphragm is a slot in which the sample to be tested is inserted, and beyond the iris is the photo-electric cell. The amount of energy developed by this cell is proportionate to the light striking it and a reading of the energy developed by the cell indicates the percentage of opacity or transparency of the sample. The tester is being used to grade paper stock, to determine the transparency of different kinds of glass, and to test the sheerness of fabrics, such as stockings and dress material.

MAGNETIC SWEEPER PICKS UP PIECES OF PLATINUM WIRE

In the manufacture of the little lamps for switchboard signals, platinum is used for that part of the leading-out wires passing through the glass wall of the lamp because it has about the same heat expansion. The platinum wire is welded to a larger wire on which the filament is mounted, and some of the platinum is lost in handling, many of the particles of this costly metal dropping to the floor. Heretofore the platinum particles were salvaged from the factory floor by using a small magnet as the wire has a steel core. Recently, however, a magnetic sweeper has been made for this purpose. It consists of a number of individual magnets placed side by side on a frame provided with wheels and a handle. The sweeper is pushed over the floor several times a day, like a vacuum cleaner.

MOON'S SURFACE WITHOUT AIR ITS LIGHT HAS PROVED

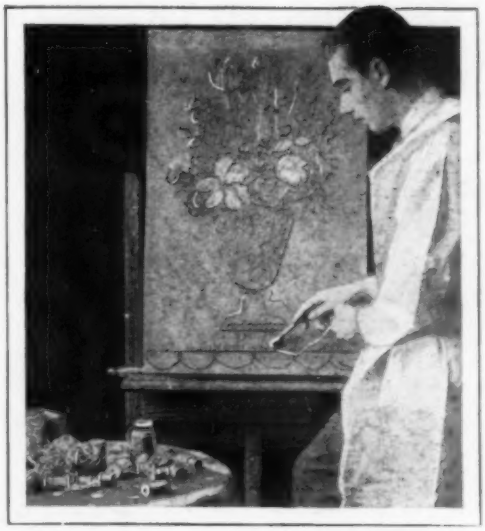
Examination of the ultraviolet rays present in full moonlight has proved conclusively that the surface atmosphere of the moon is virtually without oxygen. Dr. Brian O'Brien, of the University of Rochester, made the test by measuring the spectrum, or rainbow, of moonlight. The

test depends on ozone, a form taken by some of the oxygen in the sun's light. It is opaque to certain kinds of ultraviolet light, and as no difference can be observed in the strength of these colors in the light reflected from the surface of the moon as compared with light direct from the sun, the absence of oxygen on the moon is shown. The presence of ozone in the earth's atmosphere did not interfere with the experiments.

DOGS AS SILENT POLICE USED ON DETROIT STREETS

Dogs play an important part in anti-crime activities. Among the most efficient members of the Detroit police department are seven German shepherd dogs which have a perfect record in stamping out crime in the lonely sections which they patrol. Every night each dog walks a beat with a policeman, and so efficient have the animals become that not a single house prowler has been reported in their district in over three years. The police dogs are first trained to strict obedience and to respect the police uniform. They are then taught to jump, so they can clear fences or hedges in trailing a suspect. The most difficult drill for the animals is to carry on in the face of gunfire, and they learn to attack under the blaze of blank cartridges.

Training Police Dog to Protect the Officer with Whom It Works in the Face of Gunfire



An Example of Mural Wall Decoration with the Figures Outlined in Strings of Various Colors

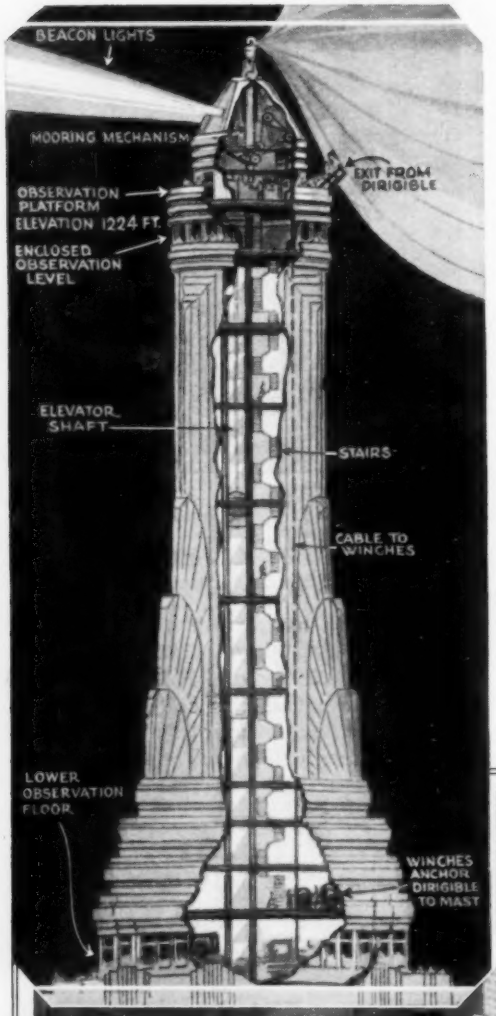
COLORED STRINGS FOR MURALS MAKE WALL DESIGNS

Murals with figures outlined in colored strings are being employed effectively for wall decorations by one American mural painter. The strings, in colors to correspond to the flowers or other figures represented, are glued to the murals to provide an artistic and colorful outline.

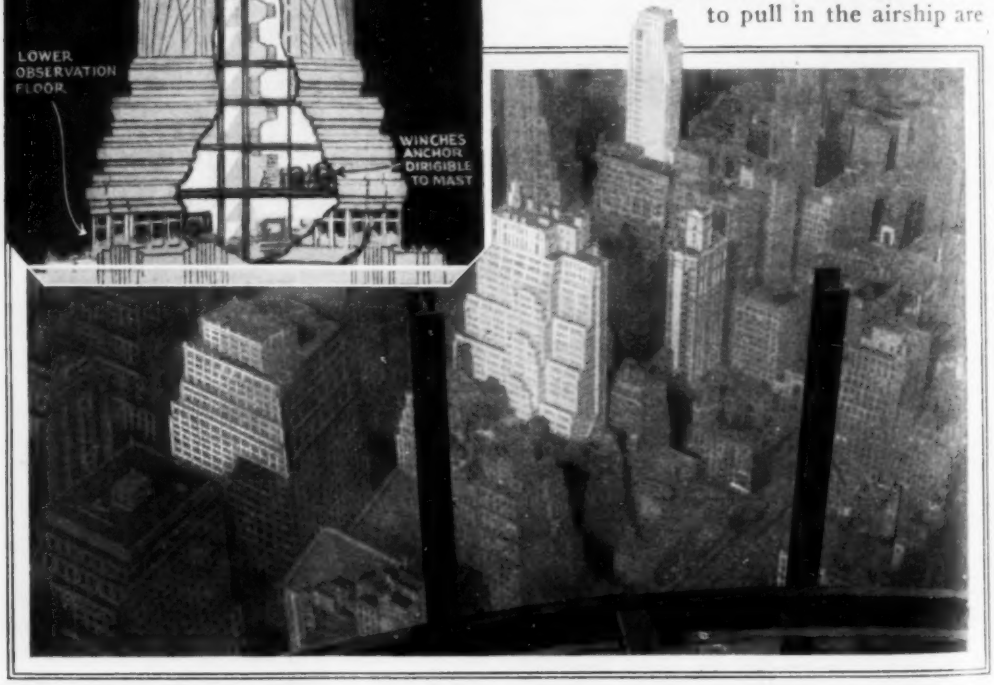
GROWTH OF TREE IS WATCHED UNDER THE MICROSCOPE

Days are transformed into minutes, and years into weeks by a method of studying the growth of the root tips of pine trees under the microscope. Instead of waiting years to find the effect of a fungus attacking the tree roots, the work of years of growth can now be studied in a few days. The pine seeds are sprouted in a solution made to duplicate the ideal forest soil. The solution, containing root nourishment, passes into the root chamber, and is taken off through a drain pipe. A fresh supply of nutriment constantly replaces the solution drained off, so the roots are continually gorged with food. The roots react to this ideal condition, and can actually be observed in process of growth. Various fungus growths can be studied as they act on the root tips, and remedies also can be observed in action.

DIRIGIBLE TO TRY MOORING TO SKYSCRAPER MAST



Despite the conflicting opinions of many experts, an attempt is to be made to anchor the huge dirigible "Los Angeles" to the mooring mast that has been erected atop the towering Empire State building over the heart of New York City. Ever since plans for the mast, costing $160,000 and extending 1,248 feet above the sidewalks, were announced along with the daring scheme to moor transatlantic air liners to the tip of the world's tallest building, the subject has attracted international attention and caused widespread discussion as to the possibility of its successful operation. Now the mast itself is finished, and former Gov. Alfred E. Smith, representing the builders, has announced that Adm. William Moffett has agreed to test its practical application. Airship experts, however, continue to condemn the plan as impractical. Those favoring the project point out that the four main pillars of the Empire State building have been strengthened to withstand a fifty-ton pull by a dirigible attached to its mast. The winches for the cables to pull in the airship are

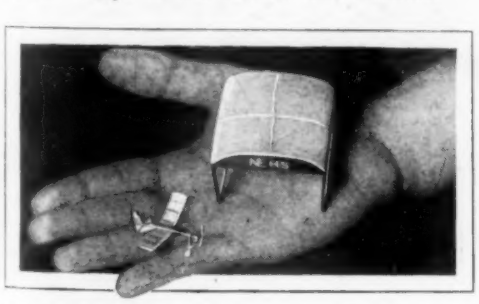


Above, Cross Section of the Mooring Mast on Empire State Building and Manner of Operation; Below, a View of New York Taken from the Top of the Mooring Mast

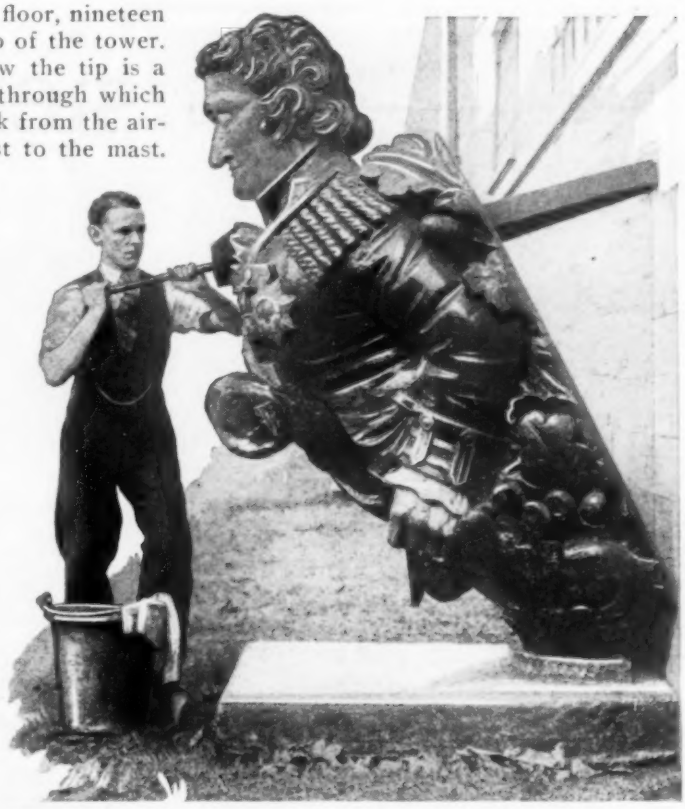
located on the eighty-sixth floor, nineteen stories below the actual tip of the tower. Two or three stories below the tip is a door, which turns inward, through which passengers might disembark from the airship, once it was made fast to the mast. Dr. Hugo Eckener, commander of the German "Graf Zeppelin," said he would never try the feat with his own ship. The air over a city, he explained, is as irregular and "spotty" as the crags of the skyscrapers, particularly at the level of building tops. As a result, the ship, in his opinion, would be in constant danger of veering off and crashing into some other building, even on a quiet day. Even if the ship were tied to the mast, he declared, it would not be quite safe.

TINY MODEL PLANE FLIES FOR ONE MINUTE

Constructed of balsa wood and Japanese rice paper, a tiny model airplane, no larger than a June bug, has been made by a Philadelphia high-school boy who has dubbed his ship the "Flying Flea." The craft has a wooden propeller and a rubber-band motor and its proportions correspond to those of a full-size plane. It measures one and one-fourth inches in length, and both the ship and its hangar can rest on the maker's hand. The "Flea" stays in the air for one minute.



The "Flying Flea," a Tiny Model Plane That Flies, and Its Hangar Resting on Builder's Hand



Figurehead of the Old British Battleship "Rodney," Receiving Its Annual Spring Bath and Cleaning in an English Dockyard

FIGUREHEADS OF FAMOUS SHIPS GIVEN SPRING CLEANING

Ancient figureheads, belonging to famous old British ships dating back more than a century, are among the prized possessions of Chatham dockyard, near London. Each spring these imposing pieces are given a bath and thorough scrubbing. One of the most valued figureheads is that of the "Rodney."

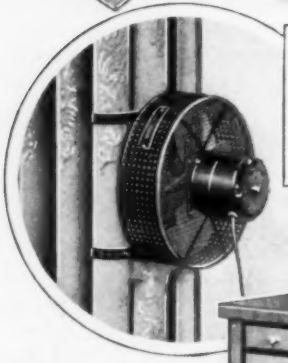
ELECTRIC EYE COUNTS LOAVES OF BREAD ON CONVEYOR

One large London bakery has applied the electric eye, or photo-electric cell, to the counting of loaves of bread as they come from the ovens on a conveyor band. The eye is mounted under the band and a light source above it. As the shadow of each loaf cuts off the light to the cell, a counting machine is set into operation.

Easier Ways

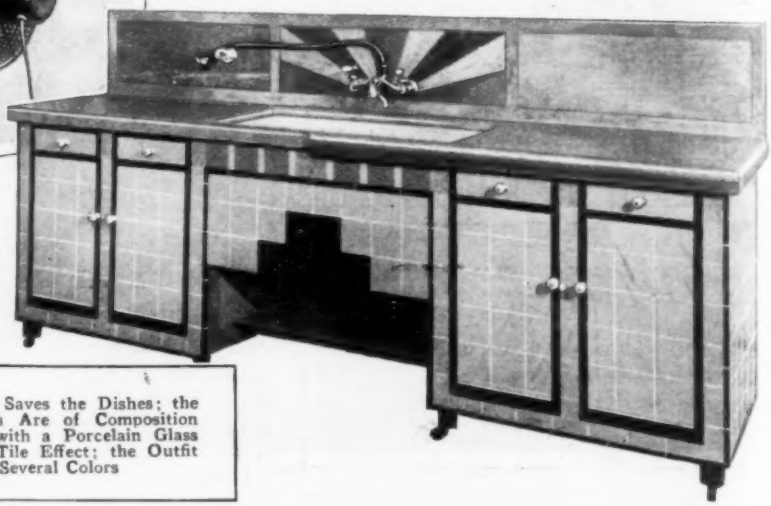
Pot Cleaner Consisting of Handle, Holder and Renewable Steel-Wool Head

Right, Perfume Diffuser Operating through Oxidation to Disseminate Liquid in Base through Wick with Platinized Heating Element at Top



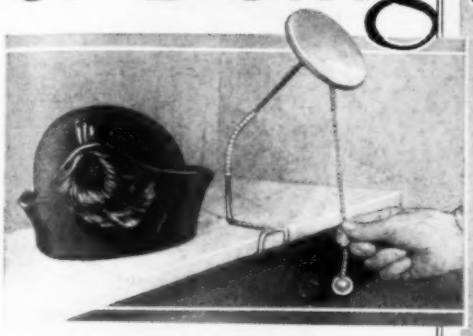
Food Shredder That Will Not Cut the Fingers; a Metal Plate Protects Fingers at All Times; Right, Iron Rest That Stays on Board

Electric Radiator Fan Which Increases Radiation by Forcing a Larger Amount of Air over Radiator, Resulting in Quicker Heating



Rubber Sink That Saves the Dishes; the Cupboards Beneath Are of Composition Hardwood Fiber, with a Porcelain Glass Finish to Give a Tile Effect; the Outfit Comes in Several Colors

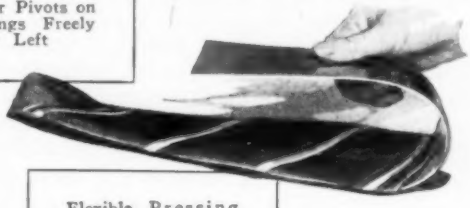
# of Doing It



Hat Holder with a Spring for Use on High Shelf; a Slight Pull on the Cord Brings Hat and Holder within Easy Reach

Extension Garment Hanger for the Clothes Closet Which More Than Doubles Usable Space; the Hanger Pivots on Hinges and Swings Freely to Right or Left

Broiler with Hinged Top That Is Easily Cleaned; Meat Juices Run off Ribbed Top and into the Pan at the Bottom



Flexible Pressing Form for Neckties Made of Bakelite; Ties Also Can Be Dry-Cleaned on This Form

Below, Window Ventilator Screen on a Roller; the Net Screening Is Washable

Ornamental Flashlight That Turns On When Lifted; the Contact Is in Its Base

GOLD LEAF IS STILL BEATEN OUT BY HAND POWER

Above, Putting the Gold Squares into Containers for Beating; Top, Center, Cold-Rolling an Ingot; in Circle, the Finished Leaf Which Is Nearly Transparent; Right, Cutting the Leaf after the First Hammering

At least one industry has not greatly changed in this modern machine age, for gold-leaf making remains one of the few occupations where hand power does most of the work. Gold leaf usually has its beginning in an ingot weighing about 350 pennyweights. This ingot is run through a cold roller and made into a ribbon about 150 feet long and one inch wide. The ribbon is cut into one-inch lengths and placed in containers of so-called goldbeaters' skin, each square inch being beaten by hand until it is about five inches square. This process of cutting and hammering is repeated three times, each inch length of the original ribbon yielding sixteen finished leaves, and the ingot making about 3,000 leaves.

SECRET BURGLAR ALARM RINGS IF WATCHMAN IS WAYLAID

Thieves entering a place where a night watchman is on duty usually force the watchman to make his regular rounds and "pull" his signal boxes on schedule, so the central office to which he reports will not suspect anything wrong. To thwart this system, the latest signal box for watchmen is equipped with a special key which is operated only in one particular way. The box looks like any other signal box and the key looks no different, but unless the key is turned in one way, and unless a certain pressure is exerted, the alarm is turned in automatically despite the fact that the box appears to have been rung in the usual manner. A watchman thus is able to raise an alarm without arousing the suspicions of those accompanying him.

¶By lending more than 14,000,000 books annually, the Chicago public library has the world's largest circulation.

AIR BUMP IS GREATEST STRAIN ON A FLYING PLANE

Air bumps offer greater strain to a plane in flight than the shock of landing, it is revealed by tests with "electric nerve centers" placed aboard the ship to measure such stresses. The air bump showed a strain as high as 18,000 pounds on an airplane weighing only 8,500 pounds. The nerve centers are placed on a wing, fuselage and landing gear and connected by wires to a box containing six grid-glow tubes registering pressure from 14,000 to 22,000 pounds. The tubes are lighted when the electric nerve center signals an impact, the contact points being tiny weights strapped by springs into aluminum castings. The device showed high-speed landings offered less strain than slow ones. When the speed was over sixty miles an hour, no pressure was recorded, indicating it was less than 14,000 pounds. At less than fifty miles an hour, the pressure on landing was increased on both wings and landing gear. No shock was recorded at a take-off.

INFLATED BOAT BECOMES TENT FOR CAMPERS AT NIGHT

So light and compact that it can easily be carried on the back when folded, a sporting outfit in the form of a rubber boat and tent is finding favor in Germany. The inflated rubber craft supports a large weight on the water, and when beached at night, has a cover which transforms it into a cozy tent for campers. It is prepared for the water or for carrying in a few minutes.

Inflated Rubber Boat for Campers Which Is Transformed into Tent at Night; When Deflated, the Outfit Is Carried on the Back

Sending a Telegram from a Flying Plane; the Message Is Transmitted by Radio and Then by Wire

TELEGRAMS SENT FROM PLANE BY RADIO-WIRE HOOKUP

Passengers on some European airplane routes now are able to send private telegraph messages while in flight. This is made possible through an agreement on a fixed tariff by the aerial radio service of the route and the post administration offices of Czechoslovakia and Austria. The messages are sent by radio to the airports and forwarded by telegraph to the addressees. Code messages are not accepted.

WHY SWISS LAKES ARE BLUE

Travelers long have marveled at the beautiful azure color of the lakes in the Tyrolean Alps, and chemical compounds in the water were generally believed to cause the color. Recent analysis, however, shows the lakes to be free from coloring matter. Scientists therefore have decided that the hue is due to reflection and refraction of the azure sky in colorless water, particularly since the azure color changes to gray as the sun declines. Other localities do not have the deep-blue water coloring because they are not favored with clear blue skies.

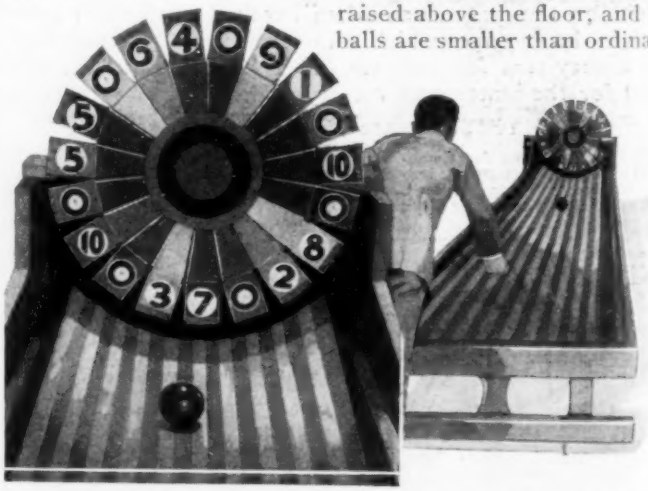
Section of Enameled-Steel Surfacing for Interior or Exterior Walls; Note Method of Assembly

BUILDING OF ENAMELED STEEL OFFERS COLOR VARIETY

Colors in endless variety are offered along with other advantages in an enameled-steel wall surfacing for buildings which can be employed for both interiors and exteriors. Such all-metal construction is intended particularly for automobile-service stations, shops, cafeterias, and other places where bright, individual colors are necessary. The wall surfacing is composed of sections of steel, eight by sixteen inches, on which porcelain enamel has been sprayed and burned in to make the metal rust-proof. The wall sections are simply slipped into place after studding, in the form of I-beams, has been bolted to the metal frame of the building, a flange at each edge of the wall section fitting over an edge of the studding. Putty is placed in the slots before the sections are slipped into place, and insulation is further aided by a layer of mineral wool between the wall surface and an inner surface, and by a dead-air space beyond the mineral wool insulation. The edges of the enameled sections overlap to make a tight connection. In addition to being fireproof and offering any color or decorative effect, such wall surfaces are kept bright and clean easily.

ELECTRIC BOWLING ALLEY HAS NO PINS TO SET

Bowling, one of the few sports to remain virtually unchanged in an age when others are constantly altered, now is being electrified. An electric bowling alley offers several additional hazards for the pin smasher, since the pins are not stationary but are set on a vertical wheel that revolves at constant speed. This variation of bowling is known as "rolette," and the player must co-ordinate sight and skill, since he must roll the ball so it will arrive at the exact moment the pin he intends to hit is in position. The pins consist of nineteen numbered spokes on the wheel which is operated by a motor. The numbers are arranged in groups of two which add ten, except for two spokes which bear the number ten, and others with zero on them. When the numbers are struck, the spokes fall back against an arm and are set upright by pulling a wire running the length of the alley, thus eliminating pin boys. The player is expected to call the number or combination of numbers he expects to hit before throwing the ball. The alley is slightly raised above the floor, and the balls are smaller than ordinary.

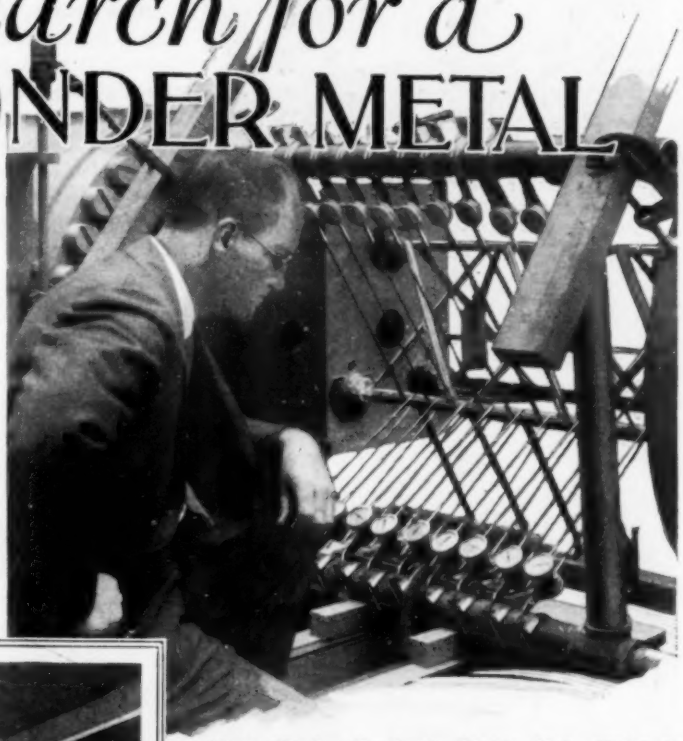


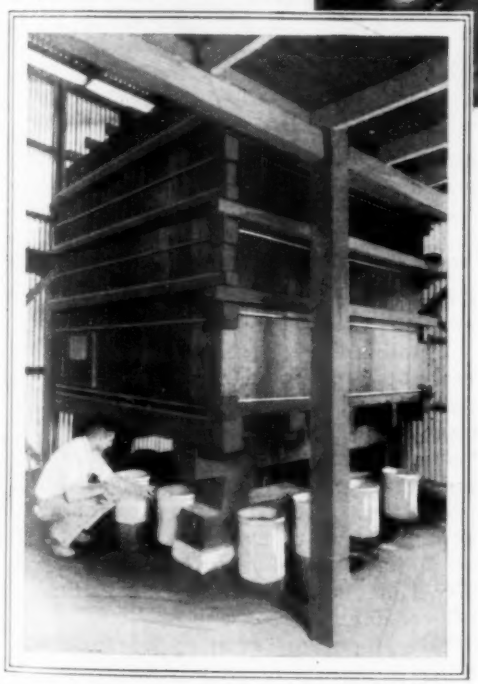
Electric Bowling Alley with the "Pins" Set on a Revolving Wheel; Considerable Skill Is Required to Strike the Number Combinations

The Search for a WONDER METAL

OUT of what cauldron of science will flow the wonder metal that will make possible bridges with an indestructible span of 5,000 feet? Airships light as thistledown, yet dwarfing any thus far produced? Ocean liners more gigantic than the greatest of present-day leviathans?

Three hundred government scientists are working on this problem. During the past year, they have obtained and



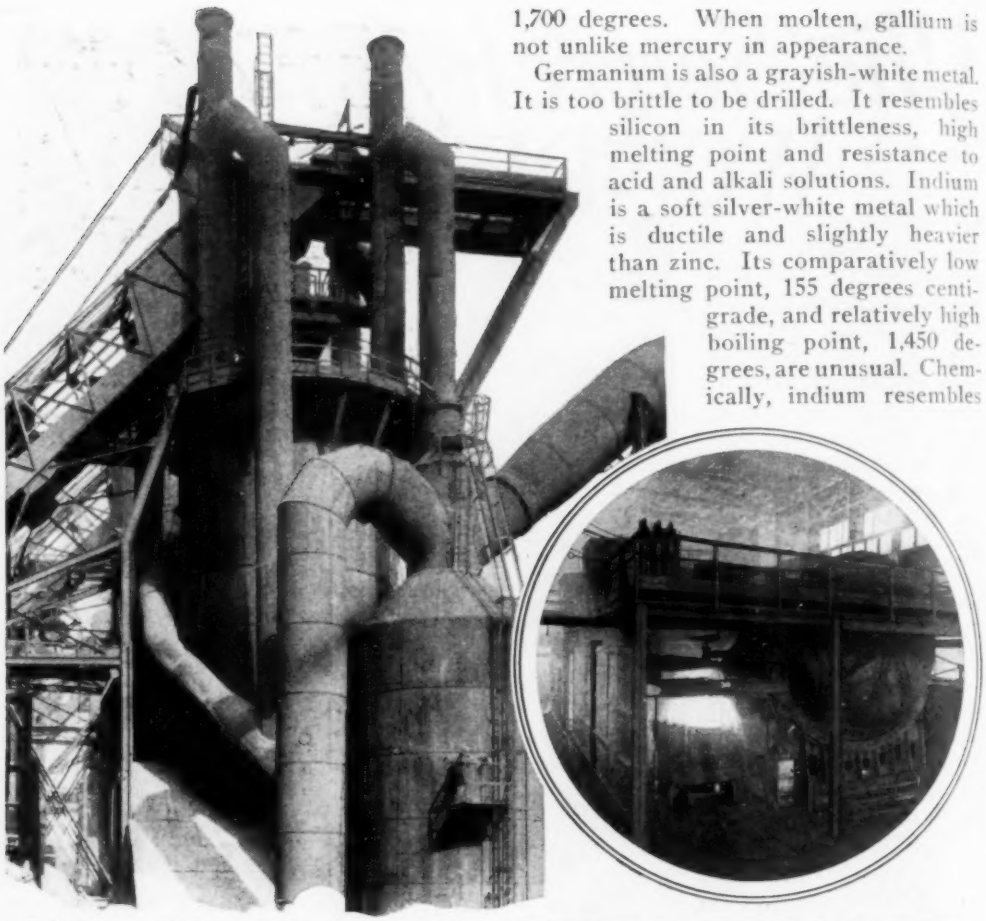


Above, Testing Duralumin Airship Girder Which Is Compressed While Eighty-Two Gauges Locate Any Weak Spots; Left, Apparatus Which Separates Liquid Metallic Substances into Their Various Elements

analyzed more than 10,000 specimens of rocks and rare metals, some of which were found 8,000 feet down in the ground. The metals are sliced into thin wafers for study, and are then placed in electric furnaces to produce alloys that may possess the desired properties of strength, lightness and durability.

X-rays of the earth are being made to locate unknown metallic substances, and core samples of these materials are obtained by means of diamond drills. The X-ray photographs are made with seismographs which register the vibrations of natural and artificial earthquakes through different kinds of metals. These unknown metals are designated by numerals until the scientists have ascertained their elements.

The latest discovery in this field is the identification of element "No. 75." Dr. W. F. Meggers, of the bureau of standards, has named the substance "Rhenium 75," the figure "75" representing the number of electrons contained in the metal. He says that "Rhenium 75" is a thousand times more rare than gold, and constitutes



Left, Apparatus Used by Metallurgists to Reclaim the Metallic Substances from Low-Grade Ores and Waste Steel-Foundry Products; Right, Electric Furnace Where Steel Alloys Are Made

about one part in a million million of the earth's crust. Research will be made of the commercial utility of the new metal. Doctor Meggers has also begun the study of two, so far unidentified, elements, now known simply as "No. 85" and "No. 87."

In the search for new metals, hitherto unknown properties of metals already known are constantly being discovered, as in the case of gallium, germanium, indium and scandium. Gallium is a grayish-white metal which in certain lights shows a bluish-green color. The luster is brilliant and metallic but tarnishes quickly. The metal is tough, but is soft enough to be cut by a knife. Its most interesting property is the wide range of temperature through which it remains liquid. The melting point is about thirty degrees centigrade, and its boiling point is in the neighborhood of 1,700 degrees. When molten, gallium is not unlike mercury in appearance.

Germanium is also a grayish-white metal. It is too brittle to be drilled. It resembles silicon in its brittleness, high melting point and resistance to acid and alkali solutions. Indium is a soft silver-white metal which is ductile and slightly heavier than zinc. Its comparatively low melting point, 155 degrees centigrade, and relatively high boiling point, 1,450 degrees, are unusual. Chemically, indium resembles zinc in some respects and is like aluminum and iron in others.

Aluminum alloys containing germanium have been prepared and tested. It has been found that the addition of small quantities of germanium to duralumin, "lautal" and "aludur" alloys, increases their strength and improves their rolling properties. Aluminum-magnesium alloys containing up to five per cent of germanium have been patented in Germany. Experiments are being made with the use of germanium in steel.

Two thousand samples of these and other structural materials, including cast iron, steel, alloy steels, ferro-alloys, brasses, bronzes, bearing metals, monel metal, and light aluminum alloys have been tested at the bureau of standards. Strength tests of models of the tower-column sections

of the Hudson river bridge now being erected, also have been made. Two of these columns, made from ordinary steel, failed at loads of about 5,500,000 pounds, whereas two columns, made from silicon structural steel, withstood a pressure of about 8,750,000 pounds.

The investigators have learned that titanium, a metal used in the manufacture of steel, is abundant in nature but is not easily recognized. Out of 800 rocks examined, 784 revealed the presence of titanium. The element has been found in the volcanic dust of Mt. Pelee, in deep-sea dredgings, in ashes of certain coals and of different kinds of wood, in cowpeas, in cotton-seed meal, in the flesh and bones of animals, in the atmosphere of the sun and in many stars.

Titanium, resembling polished steel, is hard enough to scratch quartz. It forms alloys with most of the metals, but especially with copper, tin, iron, aluminum, chromium, cobalt, molybdenum and tungsten. It is used to alloy iron and steel, and in the making of fireworks because of the beautiful light that it produces during combustion.

Cobalt is a silvery-white metal, strongly resembling nickel in its appearance and properties, and is being used in the cobalt-chrome series of alloys known as "stellite." A new metal, called "konel," which contains cobalt, nickel and ferro-titanium, is said to be a satisfactory substitute for plantinum in many of its uses. It was originally developed for use in filaments for radio tubes, but since it is harder than cold steel even when it is red-hot, it is adapted for a variety of uses, such as in the moving parts of internal-combustion engines.

ELECTRIC AIR FILTER SERVES AS WINDOW VENTILATOR

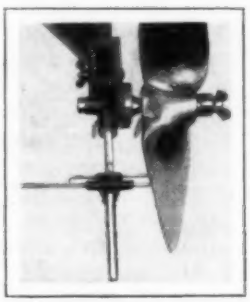
Operating from any wall outlet, an electric air filter for the home or office cleans the air which passes through it of dust and dirt, and at the same time keeps out street noises, it is claimed. The ventilator is contained in an oblong cabinet and consists of twin-blower fans operated by a small motor, an air filter to remove dirt, dust and pollen, and a sound filter to silence outside noises. The air-filter sheets

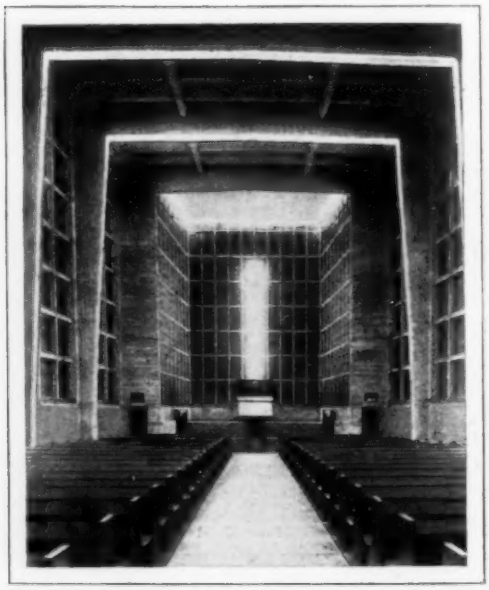
Office Equipped with Electric Window Ventilator, Which Filters the Air Passing through It

of paperlike material are replaced about once a week, when they become filled with dirt and impurities. The ventilator, by stopping pollen, proves helpful to sufferers from asthma and hay fever, and it may also be employed as a heat booster for a sluggish radiator, or fitted with a humidifier to assure proper vapor content.

GAUGE FOR BOAT PROPELLERS SHOWS PROPER SETTING

Determining the proper pitch for boat propellers often involves tedious calculation on the part of builders and operators. To make this task both easy and accurate, a gauge now shows the pitch, the fore-and-aft rake and the angles between the blades of propellers. In outboard racing, for instance, one pitch often makes a difference of 500 revolutions per minute, and in high-speed inboard craft, the taking of sharp turns may increase the pitch of the wheel propelling the boat, and in addition the blades may be bent. The gauge can be clamped to the boat or to any handy upright support. The largest size will handle a thirty-inch wheel with shaft bore up to two and one-quarter inches in diameter.





Auditorium of a Steel Church in Germany; Note Extreme Simplicity and Indirect Lighting

PLAIN LINES OF STEEL CHURCH SHOW MODERN TREND

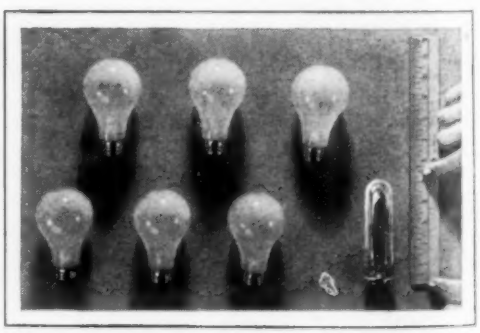
Simplicity is being emphasized in the modern trend of architecture in Europe, and is nowhere better emphasized than in a steel church at Dortmund, Germany. A view of the auditorium reveals extreme plainness with no attempt at decoration to relieve the angles, the simple pews carrying out the same idea.

AUTOS CAUSE MORE FATALITIES THAN THE WORLD WAR

More lives were lost in the United States during the eighteen months ended Dec. 31, 1930, as a result of automobile accidents than by the American forces during a year and a half of the world war, a recent survey shows. During eighteen months of the world war, 50,510 American soldiers were killed in action or died of wounds. In the last year and a half, 50,900 persons lost their lives in automobile accidents in this country. The 1930 toll was estimated at 32,500, an increase of 1,200 over 1929, although gasoline consumption dropped more than a billion gallons in 1930. Men were behind the wheel in ninety-three of every hundred accidents in 1930. Whether the better record of women is due to better driving, or not covering as many miles, is not indicated. In over half the fatal accidents, the drivers were between the ages of twenty-five and fifty-four. One-half of the fatalities occurred in collisions with pedestrians, one-fifth in collisions with automobiles, and about one-tenth in collisions with fixed objects. Over half the non-fatal injuries were from collisions with other cars. About nine-tenths of the killed and injured were victims of cars in good mechanical condition, and most of the automobiles involved in accidents were private passenger cars. Three specific driving violations accounted for sixty-eight per cent of the 1930 accidents. They were exceeding the speed limit, driving on the wrong side of the road, or failing to grant right of way.

LARGER HOME MOVIE VIEWS GIVEN BY NEW LAMP

Delivering a light intensity much greater than has been available previously, a seventy-five-volt 375-watt lamp has been produced for the ordinary sixteen-millimeter movie projector. This intense light for the amateur projection apparatus depends for results on a tremendous light concentration in a small area, and hence the lamps that produce more light than half a dozen sixty-watt bulbs are only about one-third as large as the ordinary bulb. Projectors using such a lamp can show black and white pictures twelve feet wide distinctly, and colors also can be shown on a larger screen than the ordinary. The light develops considerable heat, but a projector equipped with an efficient fan-cooling system takes care of this situation.



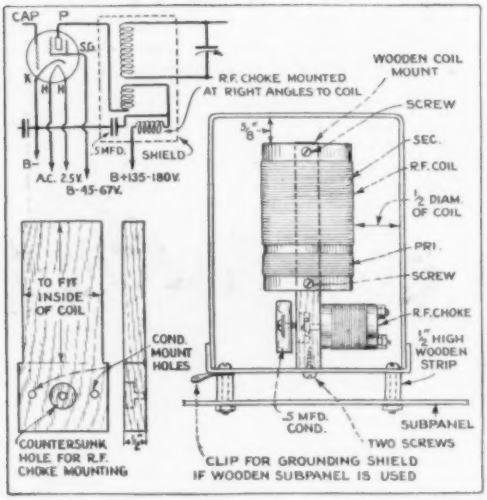
Tiny Movie Projector Lamp, Lower Right, Which Gives as Much Light as Six Bulbs Shown

LOST PEOPLE ARE SOUGHT ON ROOF OF THE WORLD

Courtesy Mejrabpom

Scientists Traveling among Ice "Ferns" in Pamir Mountains, Known as the "Roof of the World," in Search of a "Lost People"; Some Believe This Region the Original Home of the White Race

German and Russian explorers and scientists recently have been trying to solve the mystery of a "lost people" reported to inhabit a lonely mountain fastness on the "roof of the world," as the wild region in the Pamir mountains, back of the Hindu Kush range and the Himalayas of central Asia, is called. It is thought by many that this rugged region may have been the original home of the white races, or Aryan peoples. One theory is that these mountaineers are the remnants of an ancient civilization, perhaps allied to that which left buried cities in the Gobi desert, while others believe the people may be the descendants of the soldiers of Alexander the Great. Present day nomads tell a fantastic story of a strange people in these mountains who possess supernatural powers, but expeditions sent in the past have failed to find them, or even to penetrate the land of the Pamirs. The Russian and German caravan started from Turkestan and, at the approach to the Pamirs, enlisted the aid of a tribe of nomads who led them over the mountains and into the icy world on the roof of the globe where the people must live in the lowest valleys because of the rarefied air which, through a strange disease, takes a heavy toll of lives. Here the explorers traveled through great fields of ice "ferns," and after scaling a mountain peak 21,000 feet high, began their search for the lost people. Led by rumors and stories, the scientists crossed and recrossed the unknown country and uplands, invading mountainous wilds and apparently uninhabited regions, but failed to find any trace of the persons they sought. So sure are the scientists that there is some real foundation for the stories however, that another expedition already is being equipped to explore the "top of the world" even more thoroughly in the hope of actually meeting these peoples.

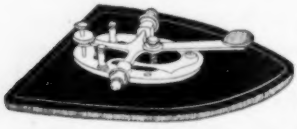


Increasing Gain of R.F. Coils

Screen-grid coils, both a.c. and d.c., must be carefully by-passed and shielded if maximum gain per stage is to be expected. The r.f. choke and by-passing condensers, shown in the diagram at the upper left, should not be omitted. Proper shielding is very simple as the coils are small and may be inclosed in aluminum drinking or measuring cups. It will be noted that the choke coil and the .5-mfd. condenser are also inclosed within the shield. The diagram for building this unit is self-explanatory and requires little comment. When a wood subpanel is used, it is a good idea to raise the shield, in the manner shown, so that the wires may be brought out of the shield base instead of running through the subpanel.

Portable Radio Key Is Mounted on Flatiron Base

A sending key, screwed to the operator's table, cannot be removed without leaving unsightly holes nor can it be moved to accommodate various postures the operator may assume when sending.



The writer made his key portable by mounting it on the base of an old electric iron. The base was painted with black enamel, and a covering of felt was glued to the underside. Care should be taken to keep the ungrounded binding post under the key well insulated from the iron base. Mounted in this manner, it will remain in place and may be moved without scratching a polished surface.—Gilson V. Willets, San Francisco, Calif.

Raising Capacity of Variable Condensers

The radio experimenter will often find that he needs a variable condenser of higher value than those on hand. This difficulty is easily overcome by connecting a tested fixed-condenser of suitable capacity in parallel with the variable. For example, the writer had a .00025-mfd. variable on hand and needed a .0005 value in combination with it for shifting the wave bands in a small all-wave receiver. This was obtained by connecting a .00025-mfd. fixed condenser across the .00025-mfd. variable and cutting the fixed unit in and out with a knife switch mounted directly above the regular condenser dial on the front panel.

Heat Control for Soldering Irons

Soldering irons become pitted and burn out rapidly when operated on full line voltage. A control unit for one or more irons, using up to 250 watts, is now available, and the best working temperature may be had by adjusting a knob. Irons controlled in this manner may be left on the line all day without having to file the tips.

Locating Trouble in Push-Pull Amplifier

Where two type-245 tubes are used in push-pull and one shows a blue glow, that tube may be defective, or overloaded because the other tube is defective. Both tubes should be tested to determine which tube should be replaced.—Guy Newell, Bloomfield, N. J.

¶For further information on any radio construction article write to the radio department; this service is free.

You Can Build This Power Transformer

by S. H. Burns

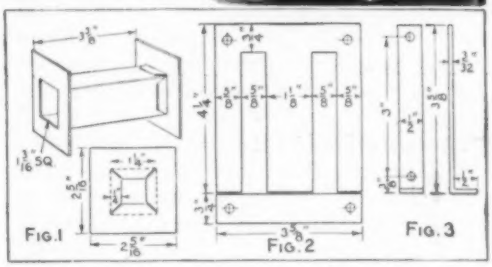
AS THE power transformer is the very heart of an eliminator, it must be designed with care, and the windings should be of sufficient capacity to deliver the desired output without undue heating. The most popular power unit in use at the present time is one that will supply a set employing three r.f. tubes, detector, first a.f. amplifier and two type-245 power tubes in push-pull. The transformer described in this article will supply the necessary high voltage and required filament current for a set of this description.

Most of the new a.c. tubes use 2½ volts, but it is necessary to separate the filament supply of some of the groups electrically, and this is easily done by providing separate windings.

Fiber is the best material for the spool ends detailed in Fig. 1, but heavy cardboard may be used instead if fiber is not available. A block of wood, 3⅜ by 1 3/16 by 1 3/16 in., is required for the form. The block should be smooth so that it may be easily withdrawn from the coil when completed. A ¼-in. hole is drilled through the block from end to end. A strip of heavy wrapping paper, 3⅜ in. wide, is then wound tightly around the block until a thickness of 1/16 in. is obtained. All but the first layer is now unwrapped and glue is applied to the inside of the strip, after which it is rewound, being careful not to get any of the glue on the block. The endpieces are cut and bent on the dotted lines and the flaps glued to the paper spool.

The primary of 440 turns of No. 21 enameled wire is wound first. Before starting this winding, refer to Fig. 4 and the assembly view, in which it will be noted that the terminals of the various windings are all brought out through holes drilled in the spool ends. Two small holes are required for each lead. Thread the wire in and out of these holes and leave about 1 in. of bared wire, to which 12-in. flexible rubber-covered leads are to be soldered. These flexible leads are designated by various colors for the different windings. Wind the primary in an even layer and cover it with one layer of paper; the second layer is wound back over the first, as shown in the photo in Fig. 5. Proceed in this manner until the 440 turns are completed, counting the turns accurately, after which the coil should be wound with a layer of friction tape.

The high-voltage secondaries, for the type-280 rectifier tube, require wire of smaller diameter; this, No. 33 silk-enamel wire, need not be wound in even layers. A hand drill will be found helpful in winding this coil. Pass a threaded length of rod through the wood block and place a nut on the rod at each end to hold the block tightly. Insert one end of the rod in the drill chuck and clamp the drill in a vise so that the handle will be at the right and the coil at the left. Wind on 400 turns as evenly as possible and cover



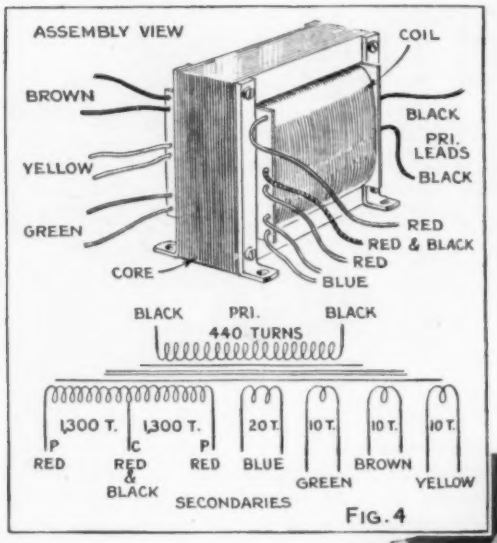
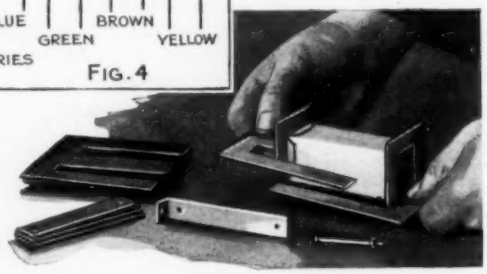


FIG. 4



with a layer of paper; add 400 more turns and cover with paper, after which the 1,300 turns in the first half of the winding are completed. At this point, without breaking the wire, bare the insulation and solder on the red and black lead for the center tap. If color-code wire is not available, paint or ink may be used to identify the leads. Wind the second 1,300 turns in the same manner, and insulate both windings with a layer of friction tape.

For the filament-heater windings d.c.c. wire should be used. The 20-turn winding, the terminals of which are indicated with blue leads, is brought out on the same end of the spool with the high-voltage leads, as these leads supply the rectifier filament and should be kept together. This winding will take up about 1 in. of the coil; the three 10-turn windings are then wound on in the sequence indicated in the diagrams and are brought out as shown. The completed windings should now be covered with a layer of tape, after which the wood block may be removed.

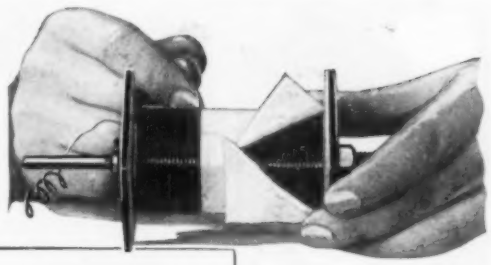
The core laminations, cut as shown in Fig. 2, may be purchased in this standard stock size or they may be cut, with snips and chisel, from stock sheet as desired. Good 29-gauge transformer iron must be used, and each piece cut to exact size, taking care to file away all burrs from the edges. The end laminations are very simple but the E-shaped ones require more care. The holes are not drilled until the core has been assembled. To fill the coil opening completely, about 80 of these laminations are required. Place the coil on its side and insert the E-laminations first in one end of the coil and then in the other, until the opening is full. At each end of the core now insert an end-piece between the E-laminations. The completed core may then be tightly clamped at each end, and the holes for the four mounting clamps drilled as detailed on Fig. 2. The mounting clamps, shown in Fig. 3, are made from four brass strips, 4⅛ in. long, and 3/16-in. holes, to match the holes in the laminations, are drilled to take four 8-32 machine screws, 1¾ in. long. Mount the footed brackets and draw up the nuts on the machine screws tightly, to prevent the laminations from vibrating.

To test the transformer for shorted turns, the primary is connected to the 110-volt a.c. line. Make sure that the various leads are well separated before turning on the current. The transformer is left on the line for about 30 minutes; if it has not heated to any extent at the end of this period, there are no shorts in the windings. Shorted turns will cause the transformer to heat very quickly, and the coil will smoke.

To test the secondary windings for correct output, the hookup shown in the head photo, and diagrammed in Fig. 5, is employed. When the primary is plugged into the 110-volt a.c. line, if everything is as it should be, the meter will indicate about 20 milliamp. flowing in the circuit. The transformer will deliver a total output of 300 volts at 100 milliamp., and with a current of 60 mils, the voltage will be about 150 volts. These data will enable the experimenter to determine other current and voltage combinations for his particular requirements.

The 20-turn winding supplies 5 volts for the rectifier filament, and the three 10-turn heater windings each supply 2½ volts, which, at the rated current values, is sufficient to operate the groups of tubes specified in the diagram Fig. 5.

A suitable filter choke for use with this power transformer will be described in detail in a coming issue. This heavy-duty choke will have an inductance of 30 henries when it is carrying 100 milliamp. Many chokes are available having an inductance of 20 to 30 henries or more, but few of them have this inductance value only when carrying comparatively little current. A power-supply unit, for a modern set, is often required to carry and filter at least 80 or 90 milliamp., and to do this, the chokes must be carefully designed.



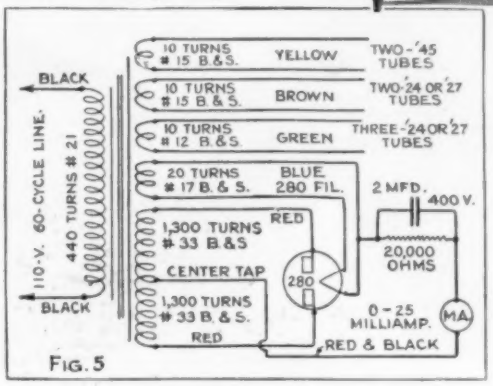
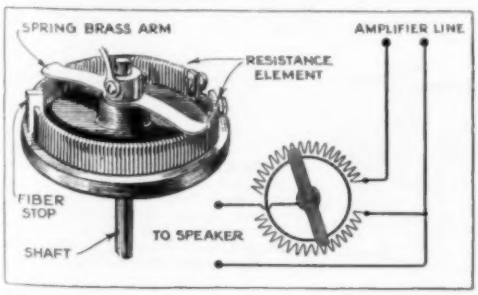


FIG. 5

With these simple units, which the experimenter can easily build for himself, an efficient power unit may be assembled in a very compact space. A diagram for building the complete power unit will be included in the coming article describing the choke.

Volume Control for Remote Speakers

A 500,000-ohm variable resistor may be used to control the volume of one speaker without affecting the volume of others connected to the same amplifier line. To do this, it is necessary to cut the resistance winding at the center to provide a constant-impedance volume control. A piece of fiber is wedged and glued between the resistor halves to act as a stop for the double wiper arm. This arm replaces the original contact arm and is made from a strip of spring brass, cut and bent as



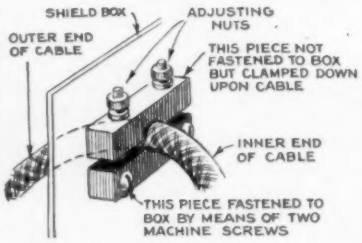
shown. A hole for the shaft is drilled at the center and the arm is held tightly against the winding by means of the retaining bushing and setscrew. When connected in the amplifier line, both resistors may be adjusted at the same time, so that when one short-circuits the speaker to reduce its volume, the other is added to the line, maintaining it at a constant impedance.—D. A. Brown, Marion, Ohio.

Operating Tungar Battery Chargers

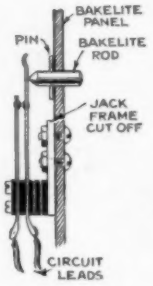
A friend of the writer had some difficulty with his tungar charger in which two 2-amp. bulbs were connected in parallel to give an output of approximately 4 amp. Frequently the charger would not deliver more than ½ to 1 amp. for a long time and then would gradually regain the normal charging rate of 4 amp. Upon investigation it was found that one of the bulbs was inoperative, and a new bulb eliminated the trouble. Trouble of this sort is not limited to battery chargers alone but may also be experienced in any other circuit where two or more tubes are operated with their outputs in parallel. Proper choice of tubes is the remedy.—Ross J. Plaisted, Brecksville, O.

Simplified to your Radio

Above, Eyelets, Pressed into Holes Drilled in Experimental Coil Forms, Save Time and Provide Excellent Terminals; Right, a Strip of Asbestos Wrapped around an Electric Soldering Iron Will Bring the Iron to a Quick Heat for Emergencies, after Which It Should Be Removed

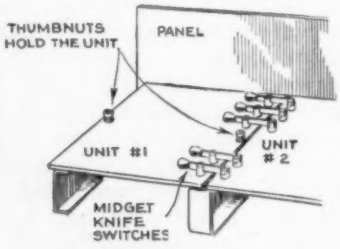

SHIELD BOX
ADJUSTING NUTS
OUTER END OF CABLE
THIS PIECE NOT FASTENED TO BOX BUT CLAMPED DOWN UPON CABLE
INNER END OF CABLE
THIS PIECE FASTENED TO BOX BY MEANS OF TWO MACHINE SCREWS

Two Pieces of Bakelite and Four Machine Screws Make a Good Cable Clamp to Prevent Strain on Small Wire Connections

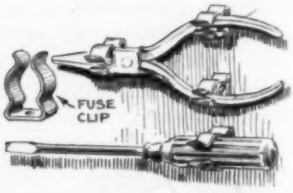


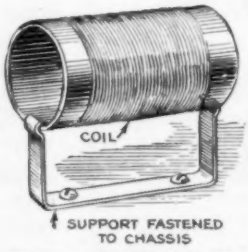
Handy Test Push Button for Occasional Meter Readings, Made from an Open-Circuit Jack and a Piece of Bakelite Rod Cut and Mounted as Shown

Removing Solder from the Prongs of an Old Tube Base for Making Plug-In Coil or Multi-Plug Connections



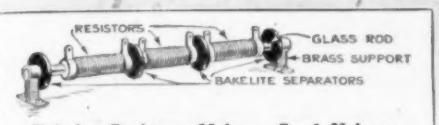
Interchangeable-Unit Idea for Experimental Circuits; Binding Posts May Be Used Instead of the Knife Switches if Desired



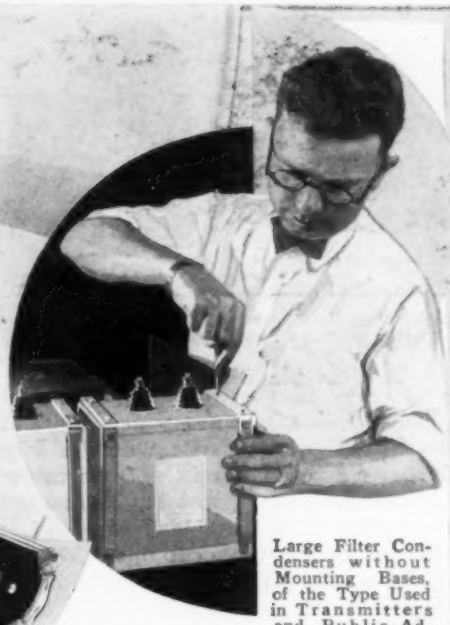


Fuse Clips Are Handy for Holding Tools on the Bench or in Portable Test Case; Left, Support for Inductance Coil Holds It Firmly, but Permits Quick Changes for Testing

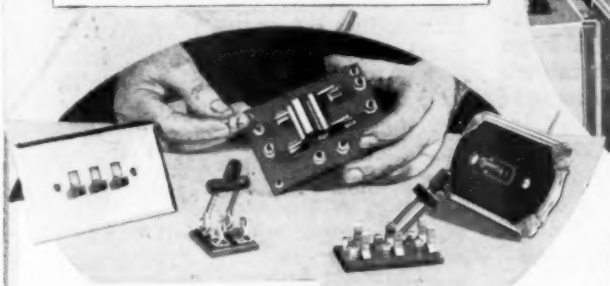
Answers Problems



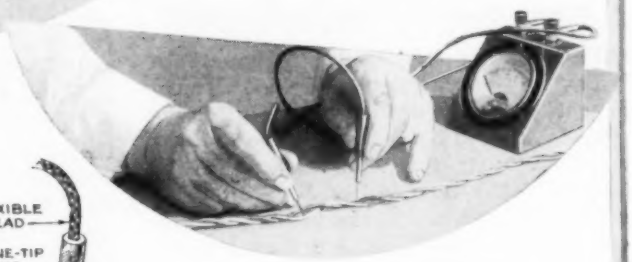
Tubular Resistors Make a Good Voltage Divider

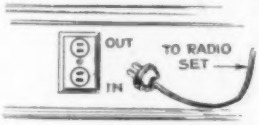


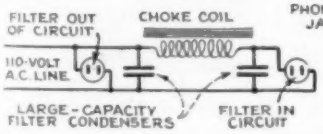
Large Filter Condensers without Mounting Bases, of the Type Used in Transmitters and Public-Address Systems, May Be Mounted on Breadboard Layouts by Means of Metal Bands at Each End; Short Angle Brackets Hold the Assembly at Front and Rear



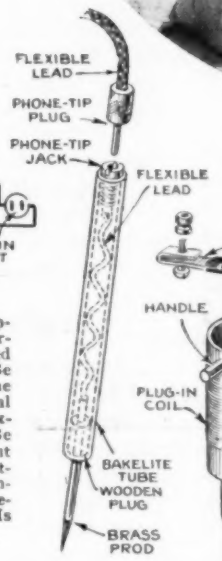
Three Handy Panel-Mounting Knife Switches Designed for the Radio Experimenter Are Shown in Center; Standard Wall-Plate Toggle Types Useful for 110-Volt Line Connections to Power Units, at Left and Right



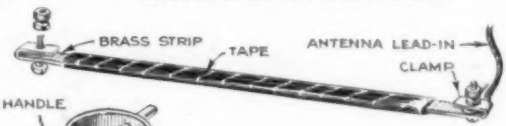


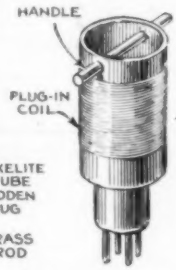


Above, a Duplex Wall Receptacle Used to Install an Interference Filter in a Concealed Position; the Filter May Be Plugged In or Out of the Line as Desired; Right, a Universal Test-Prod Arrangement; Flexible Test-Set Leads May Be Quickly Plugged In and Out of the Small Tip Jacks Mounted at the Top, Serving a Number of Useful Purposes Especially Where High Voltage Is Encountered



Breaks in Lampcord May Be Quickly Located with a Suitable Meter and Pointed Test Pins While Current Is On; Test-Prod Handles Should Be Well Insulated





Above, a Homemade Insulated Window Strip for the Antenna Lead-In Employs a Copper Strip One Inch Wide and Twelve Inches Long; Left, Plug-In Coils Often Bind in the Sockets, and a Simple Handle Is a Good Protection against Damage to the Windings When Changing Coils for Various Wave Bands

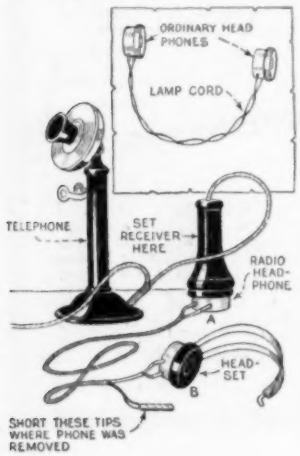
Combination Unit Showing Compact Assembly; and, Cased Instrument with Speaker Cover Opened

A Portable Speaker-Amplifier

This small speaker-amplifier combination is designed for use where a large expensive installation is not warranted. In tea rooms, clubs and roadside stands it is particularly suitable because of its low cost and economical operation. It may be connected to the radio or phonograph to furnish greater volume for dancing, or used with a microphone and portable microphone-amplifier to form a low-power group-address unit.

Handy Uses for Radio Headphones

It is sometimes desirable to have both hands free while telephoning. This may be easily arranged with a pair of headphones as shown. One phone unit is removed from the headband and connected to the free end of the connector cord. The tips, where the phone unit was connected at the band, are then shorted and covered with insulating tape. When a telephone call is received, merely don the headband B and place the telephone receiver upon the face of the radio phone, as shown at A. The insert shows two headphones in parallel to form a phone line. This works at distances up to 100 feet.

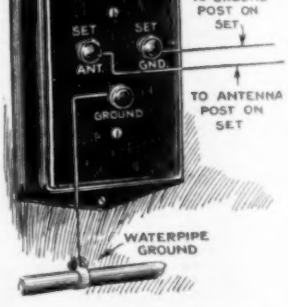


A Power Detector with One Audio Stage

A power detector to feed a single audio stage is very useful in building portable receivers where space is at a premium. A 171-A tube may be used as a detector, with 135 volts of B-battery on the plate, together with the usual gridleak and grid-condenser combination. The grid condenser should have a capacity of .0002 mfd., and the gridleak, connected across it, is a ¼-meg. resistor. The volume obtained, with this combination, is very satisfactory and the tone quality excellent. The only disadvantage is a slight lowering of sensitivity, but not enough to cause trouble in a set of this type. Another advantage is that resistance or impedance coupling is not necessary, with this form of detector, and high-gain transformer coupling may be employed due to the low tube-plate impedance even with a high C-bias.—R. Wm. Tanner, Charlotte, Michigan.

Compact Antenna for Indoor Use

Having no connection to the house-lighting lines, this new form of indoor antenna eliminates all possibility of a.c. hum. It contains a number of feet of filtered antenna wire and condensers which are said to give it the capacity of 75 ft. of ordinary antenna.



Raising Electrolyte Level

Adding distilled water to make up for loss of liquid in a trickle charger usually results in a greatly decreased charging rate. If only a little liquid has been spilled, it may be raised to the proper level by dropping glass marbles, or large glass beads into the jar. These will not interfere in any way with the operation of the charger. Purchase new electrolyte, if more than one-third is lost.

Installing an Auto Set

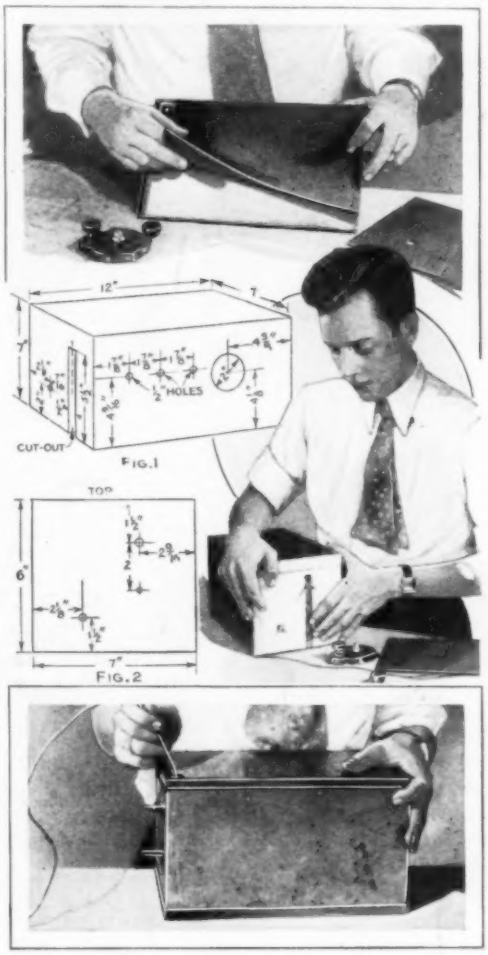
Part Two

by J. O. Barnes

THE COIL construction and assembly of the auto receiver described in Part 1 now completed, we are ready to finish the wiring and inclose the set in a suitable metal container for installation in the car. The simplified wiring diagram shows a view looking down on the chassis with the leads underneath indicated by dotted lines. The coil-shield cans and ganged-condenser unit are omitted. The gridleak and its condenser are shown in their relative position, but the multi-terminal plug has been shifted so that the various terminals could be indicated.

After all wiring under the chassis has been completed, the coil shields, together with the ganged condenser, gridleak unit and multi-terminal plug, are mounted on the chassis. The ganged-condenser frame is common with the rotors and, when mounted directly on the coil-shield cans, a ground to the negative side of the A-battery is obtained for all. In the actual wiring, as shown in the simplified diagram, resistor R_1 has been inserted in the positive A-battery lead for the detector and r.f. tubes instead of using it in the negative lead, as shown in the schematic diagram in Part 1. This enables the builder to use the chassis as the A-negative side, so that the resistor R_2 may be connected directly to it for the two audio tubes. The black A-negative lead, after passing through the switch, is connected to the chassis by means of a soldering lug under the mounting screw of the first r.f.-tube socket. Thus the filament supply to one group of tubes is controlled in the A-negative side, and the other in the positive, to save unnecessary wiring. All connections grounded to the chassis are indicated with the conventional symbol for ground.

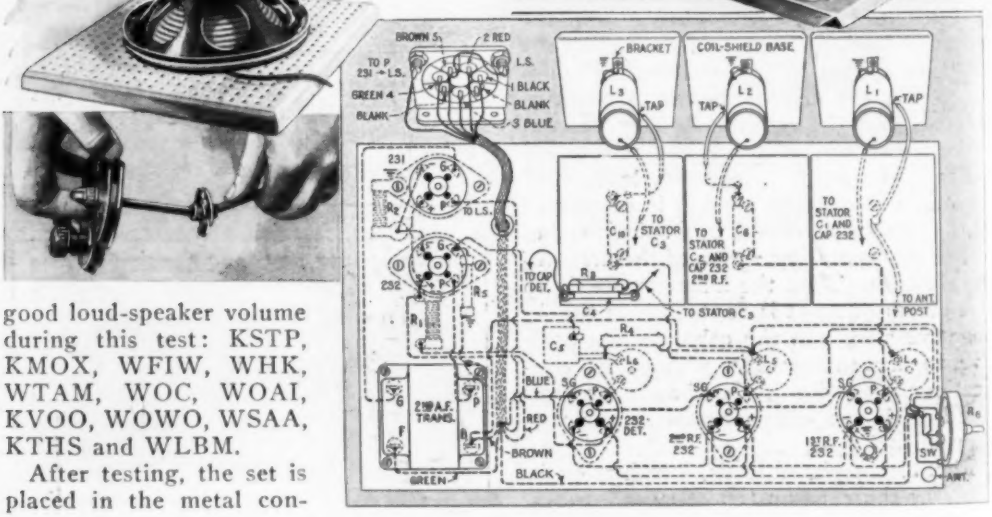
Flexible insulated leads, terminating in clips for the caps on top of the r.f. tubes, are soldered to the stators of the condensers C_1 and C_2. The flexible lead to the cap of the detector tube is connected to one end of the gridleak-and-condenser unit, the other end of which is connected to the stator of condenser C_3. The trimmer condensers C_7, C_8 and C_9 are connected directly across each of the ganged-condenser units, one



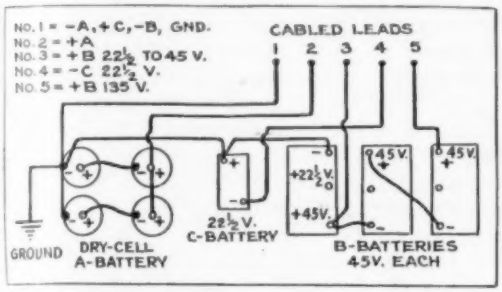
side being soldered to the stator lug and the other to the common ground on the coil-shield cans.

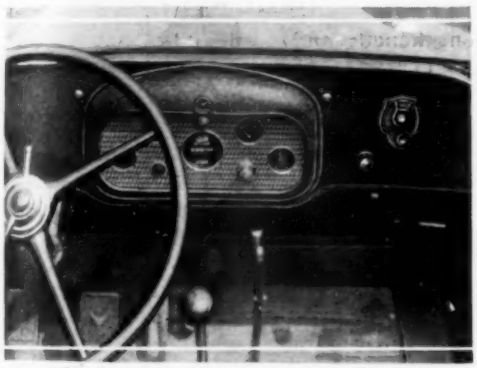
After the wiring has been completed, the batteries should be connected, as shown in the diagram on page 833, and the connector plug inserted in the terminal plug in the set, as shown in the photo at upper right on this page. Temporary control knobs are then mounted on the condenser shaft and the combination switch and variable resistor R_6. Next, the tubes are inserted in the sockets, and the set is ready for testing. A wire, 6 ft. long, makes a good antenna for this test. A weak signal is tuned in and the trimmers are adjusted with a wooden or bakelite spudger, until the station comes in at maximum strength. The following stations were received at good loud-speaker volume during this test: KSTP, KMOX, WFIW, WHK, WTAM, WOC, WOAI, KVOO, WOWO, WSAA, KTHS and WLBM.

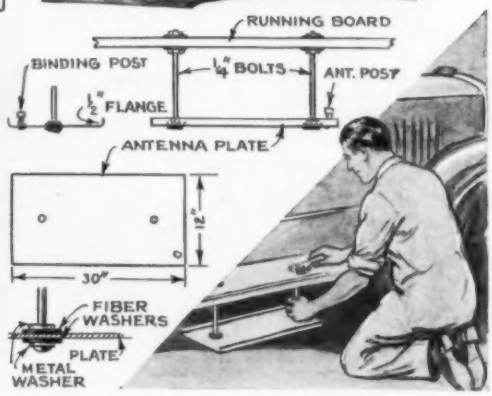
After testing, the set is placed in the metal container detailed in Fig. 1. The top and bottom covers should be cut to fit tightly, and are held in position by short machine screws through holes drilled and tapped in the cover and can. A sheet of good insulating paper is shellacked to the inside of the bottom cover, as shown in the photo above Fig. 1, and a hole is drilled in one corner for the antenna lead to the insulated antenna post on the chassis. The lower photo shows the completed assembly, bottom side up. A small bakelite panel, detailed in Fig. 2, is mounted on the front and held in position by the dial and the retaining nut on the volume control R_6, as shown in the upper photo on page 833. This type of panel assembly is used if the set is to be mounted below the instrument board, on the back of the car seat, or when in use outside the car. The photo at lower left shows the tuning dial and the combination volume control and switch mounted directly on the instrument board of the car. To do this, the leads to the combination unit are lengthened, and a flexible coupling is mounted on the end of the condenser



shaft and coupled to a length of ¼-in. brass rod, so that the tuning dial may be mounted flat on the sloping instrument board. This idea is illustrated in the photo at the lower left on page 832. The set is held in position either behind the instrument board, or on the back of the front seat, by means of strap-iron brackets. This has been left to the discretion of the builder. The trimmers are easily reached through holes drilled in the side of the container, as shown in the head







photo, for final adjustments when the set is installed in the car.

The B and C-batteries are placed in a metal box which is sunk through a hole cut in the floor in the usual manner. The dry-cell A-batteries may be placed under the seat or strapped under the cowl, as desired. Many new cars, especially sedans, are equipped with screen antenna. A good antenna device for coupes, or where the owner does not care to install one of the screen varieties, is illustrated at the lower right on this page. The closer the plate is to the ground, the greater will be the coupling capacity, but care should be taken that the plate will have sufficient clearance when the car is in motion. A good ground connection for the receiver is obtained directly on the frame of the car. The speaker may be of the small magnetic type, baffled with wood or celotex as shown in the photo at upper left on page 832, or the homemade speaker described in the February, 1931, issue will give excellent results.

Shorts in Old A.C. Sets

In the older a.c. receivers the insulated leads from the power unit were often pressed tightly together under the chassis. The rubber insulation on these wires hardens and cracks with age causing short circuits. Trouble originating from this source often is attributed to shorted condensers in error.

BUILD YOUR OWN SELECTIVE BAND-PASS FILTER

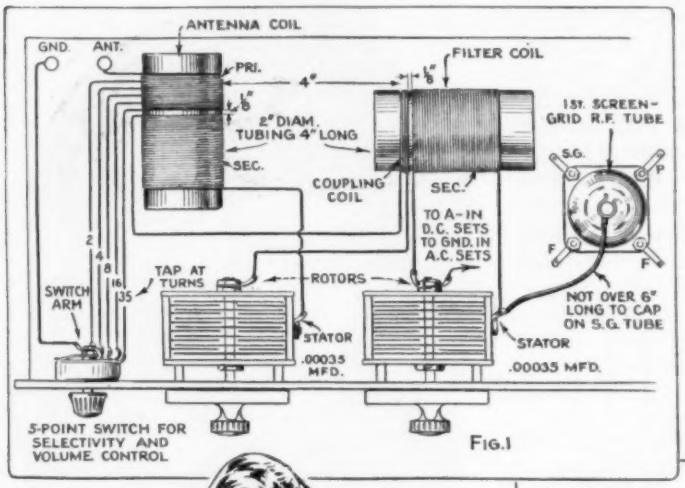


FIG. 1

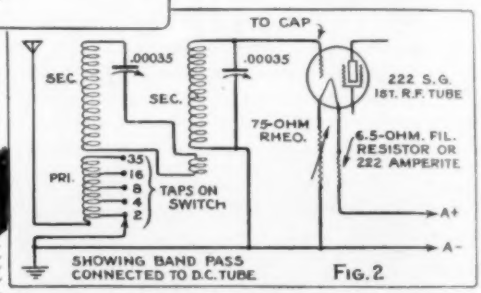


FIG. 2

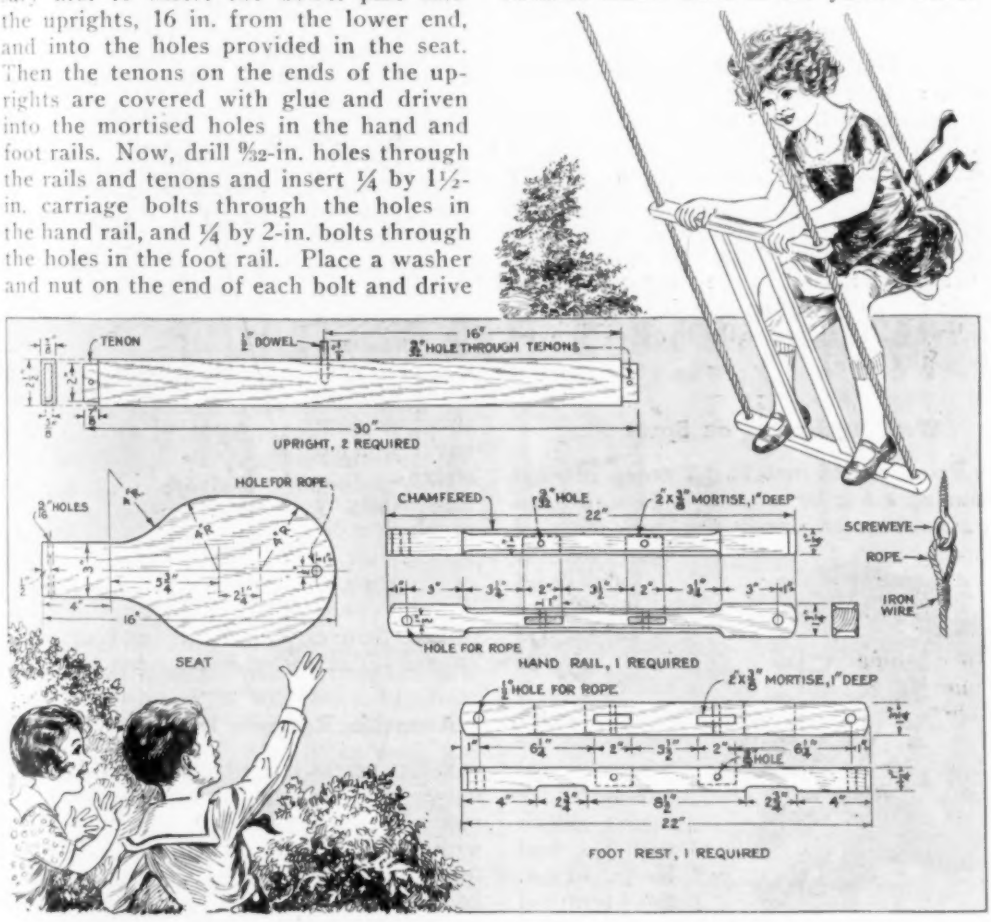
The writer has experimented with various types of band-pass filters and has finally decided on this simple arrangement. The coils are homemade and are mounted at right angles as shown in Fig. 1. They are all wound in the same direction and are spaced ⅛ in. apart on each tube. The fiber tubing is 2 in. in diameter and 4 in. long; cardboard tubing may be used if it is first coated with shellac and thoroughly dried before winding the coils. No. 28 d.c.c. wire is used for all coils and a ¼-lb. spool will be more than enough for the purpose. If .00035-mfd. variable condensers are available, the antenna coil is wound as follows: primary, 35 turns tapped at the 2d, 4th, 8th, 16th, and 35th turns. The secondary consists of 80 turns. The filter coil consists of a small coupling coil of 3 turns (see Fig. 1) and the secondary of this coil requires 80 turns. If .0005-mfd. variable condensers are used, the primary of the antenna coil is the same as before, but the secondary is reduced to 60 turns. The coupling coil will be the same but the filter secondary winding will also be reduced to 60 turns. The 5-point inductance switch helps out on the selectivity besides acting as a volume control if desired. This band-pass filter may be used with either battery-operated sets as shown in the diagram, or with a.c. sets merely by making the grid return to the chassis ground in the usual manner instead of to the negative-A as shown. The writer has received more stations with one screen-grid r.f. tube in the circuit with this device than with any other single r.f. screen-grid hookup, and thinks the idea good enough to be more widely known.

All the condensers can be ganged together, providing they all have the usual compensating condensers, but the first condenser for the antenna coil must have a small 13-plate midget condenser across it, and this midget must be controlled from the front panel. Shielding the two coils and their condensers in one shield will add greatly to the efficiency of the device. The connection to the screen-grid r.f. tube and the method of filament control are shown in Fig. 2.—Henry S. Laraby, New Haven, Conn.

Child's Swing Is Rowed Like a Boat

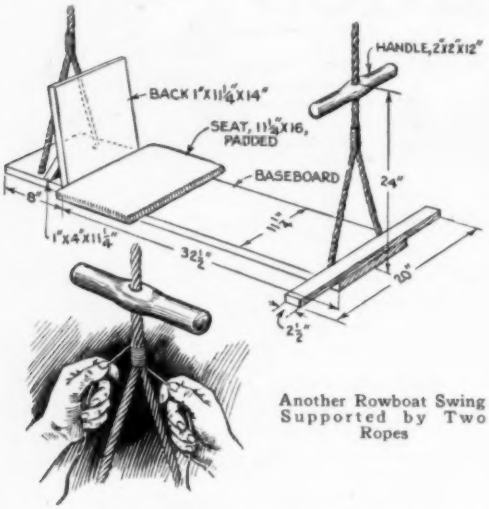
INSTEAD of being pushed by some one on the ground, this swing is actuated by pulling on the handle in the same manner as rowing a boat.

It consists of only five pieces of wood, cut to the dimensions given in the details. In assembling the pieces, it will be necessary first to insert the dowel pins into the uprights, 16 in. from the lower end, and into the holes provided in the seat. Then the tenons on the ends of the uprights are covered with glue and driven into the mortised holes in the hand and foot rails. Now, drill 9/32-in. holes through the rails and tenons and insert ¼ by 1½-in. carriage bolts through the holes in the hand rail, and ¼ by 2-in. bolts through the holes in the foot rail. Place a washer and nut on the end of each bolt and drive the nut tight. Run lengths of ⅜-in. sash cord through the ½-in. holes in the rails and seat, tying knots in the rope on the underside of the lower rail and seat, to hold the swing securely. The ropes are to be suspended from the ceiling of the porch, attic, spare room or from a suitable frame built in the yard. Three



Rowing This Swing Gives Children the Thrill of Boating, and Provides Plenty of Exercise

large eyebolts are driven into the ceiling joists, and the upper ends of the ropes threaded through these, after which the



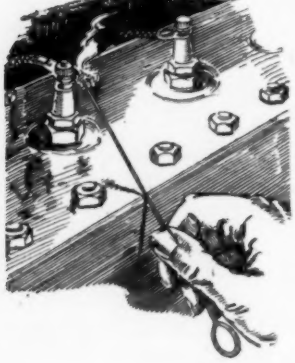
Another Rowboat Swing Supported by Two Ropes

rope is firmly spliced and bound with iron wire so that it will not come loose.

Another swing of this type, which varies a little in construction but works on the same principle, is shown in the smaller drawing. The seat should be padded for comfort, and iron wire is tightly wrapped around the rope where it is spliced. Be sure to tie a knot in the rope under each hole of the swing so that it will not slip sideways. In this case the handle is slipped over the front rope.

Wadding Ignited on Spark Plug

Being out of matches, a group of boys kindled a fire by igniting a gas-saturated wad of rags on one of the spark plugs of their car. A wire was bent at one end to form a hook to hold the wad. With the engine running, the wire was held against the motor block with the wad 1/16 in. from the terminal as shown.

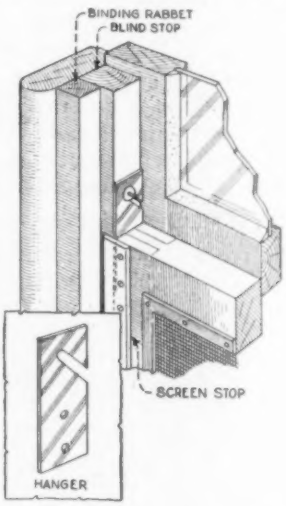


Making Model Rope Coils

If the surplus ends of halyards, lines and boat falls are neatly coiled on the deck of a model ship, the effect is much more realistic than if they are cut off at the point where they are fastened. A quick way to make such coils is to use transparent tissue paper, colored to match the deck and varnished. While the varnish is still wet, coil the rope upon it, using a long pin to form evenly spaced spirals. After the varnish has dried, use a pair of scissors to clip the paper off as close as possible to the outer spiral, and glue the whole in place on the ship's deck. If properly done, the paper will not show, and the coil is as perfect as though made with actual rope.—H. T. Bodkin, Chicago.

Improved Method of Hanging Window Screens

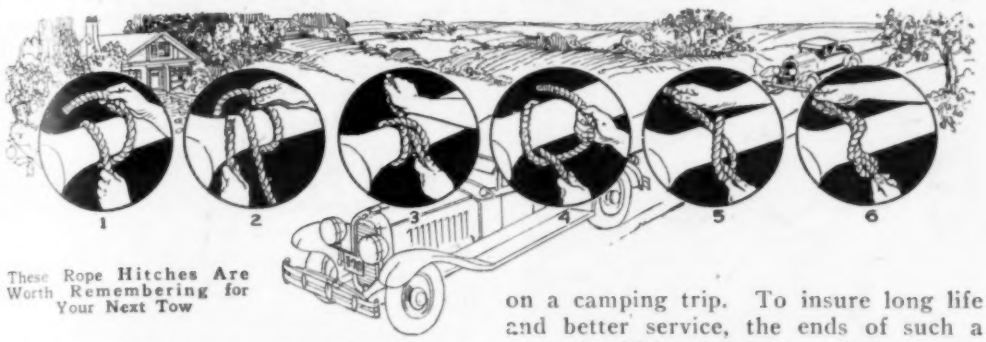
The disadvantage with the usual method of holding screens is that the small strips of molding tacked to the blind stop, over which the grooved edges of the screen are slid, warp and often break off, necessitating replacement. Remove this molding entirely and attach a strap-iron hanger in which a diagonal slot is cut as shown. Two holes are drilled through the lower end of each hanger for screwing it in place.



Ammonia Removes Furniture "Fog"

White marks left on tables or stands by flower vases or other objects can often be removed by wiping them with a rag wetted with ammonia and wrung out. After a thorough drying, the spot is rubbed with good furniture polish and the foggy stain usually disappears.

TWO TOWROPE KNOTS THAT ARE EASY TO LOOSEN

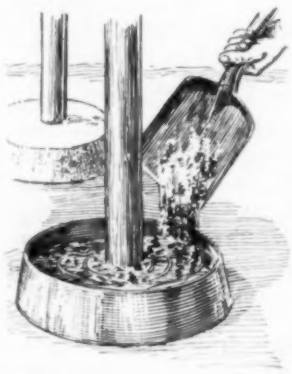


These Rope **Hitches Are Worth Remembering for Your Next Tow**

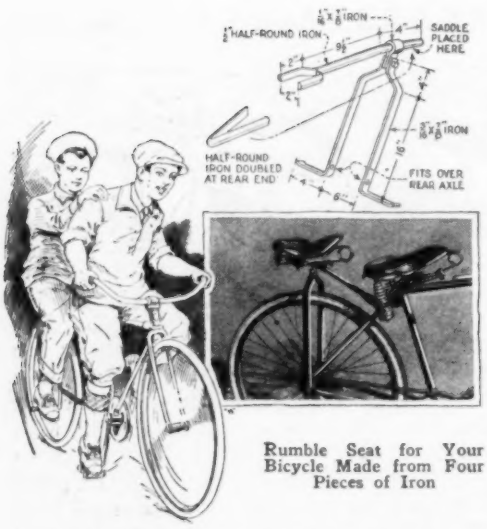
In fastening a rope to an axle or other part of a car, one usually wraps the free end about the main portion several times, ties three or four knots of one kind or another, and lets it go at that. Then, after the towing is over, the knots may have become so tightened that cutting the rope is the easiest way to loosen it. By learning how to tie the knots shown here, such trouble can be avoided. Details 1, 2 and 3 show how to form a simple "clove" hitch, the untying of which is a simple matter, as a jerk on the slack end of the rope loosens the knot. To appreciate this, try it on a cold day when your fingers are numb. In making a clove hitch, wrap the free end of the rope around the axle once, bringing it up on the right side. Then carry it across to the left and pass it around the axle again, running the end under the cross portion and drawing tight. The clove hitch is frequently used for tying pole scaffolding. Another kind of knot that you can use for fastening the towline, and one that sometimes works better with front axles and other parts that are not cylindrical, is the timber hitch, so called because it is widely used in hauling logs. The method of tying it is shown in details 4, 5 and 6. This knot, like the clove hitch, is easy to tie and is readily unfastened. Pass the rope beneath and upward over the axle once, bringing the end back and looping it about the main portion of the rope. Then wrap the end twice about the section, encircling the axle, and draw into place. Many motorists prefer a 16-ft. length of ⅝-in. manila rope to the various hook-equipped cables, wire-woven ropes or chains, as a length of ordinary rope has the advantage that it can be used for other purposes, especially on a camping trip. To insure long life and better service, the ends of such a rope should be tightly bound to prevent fraying. Waxed shoemakers' thread, fishing line or even a small-diameter wire may be used for this purpose. It is a good idea to keep the towrope in a small bag, where it will not be exposed to dirt and unnecessary wear.

Portable Posts for Supporting Temporary Fences

Where temporary fences are needed, a number of portable posts with heavy concrete bases, will be found useful. For a form, make a circular sheet-metal sleeve, about 2 ft. in diameter, 6 in. wide and slightly tapered from the bottom toward the top to facilitate its removal from the concrete. The form is laid on the ground, wide end down, and is partly filled with a rather stiff concrete mixture, after which the post is set in position, and the form filled. When the concrete has been well tamped, the form can be slipped off for use again. It is advisable to reinforce the concrete with old wire laid in circles around the post. Two high posts of this kind make good clothesline supports.



¶Castor oil makes an ideal lubricant for the automobile transmission.



Rumble Seat for Your Bicycle Made from Four Pieces of Iron

A Rumble Seat for the Bicycle

This neat bracket for carrying an extra seat on your bicycle consists of only four pieces of iron, attached with two bolts, and is as rigid as the bicycle framework itself. A little blacksmith work is necessary in bending the iron, which is best done while hot. The two uprights are made of 3/16 by 7/8-in. flat iron, bent as shown and with footrests at the lower ends. A short bolt through a socket of 1/16 by 7/8-in. iron at the top holds the horizontal member to which the saddle is attached. This horizontal member is made of 1/2-in. half-round iron, bent to form a fork at the front end. When completed, paint the frame to match the bicycle.

Clip Deflates Tubes Quickly

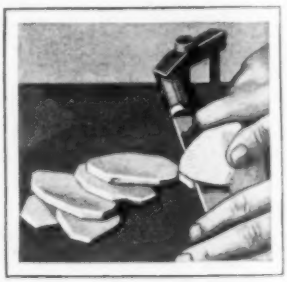
Made from a piece of spring brass, this tube deflator has been found useful and timesaving for the tire-service man. A short brass rod that will fit inside of the valve stem, is soldered to the center section of the clip to enter the end of the valve when the drilled ends are slipped over the valve stem. The ends, springing apart, lock the clip on the stem securely and the pin releases all the air.

Setting Bolts in Stone and Concrete

To fasten bolts in stone or concrete, sulphur may be used, but unless certain precautions are observed, the results may be unsatisfactory. Drill a hole for the bolt the same diameter as the bolt head. For bolts larger than 3/8 in., the hole should be at least 3 in. deep. Dry out the hole thoroughly with a gasoline torch, or by dropping a hot bolt into it. The sulphur can be heated slowly in a ladle or suitable pot. If it should catch fire, smother it. Sulphur melts at about 246° F., and at this temperature is a thin liquid, but when the temperature is increased to about 320° it becomes very thick, making it hard to pour. Therefore, the sulphur should be heated until it is all melted, when it will be quite thick, and then allowed to cool until it becomes thin enough to pour into the hole. To fasten bolts in a concrete ceiling, where sulphur cannot be poured in this way, use a thick paste of litharge and glycerine, allowing this to harden thoroughly.

Potato Slicer Saves Time

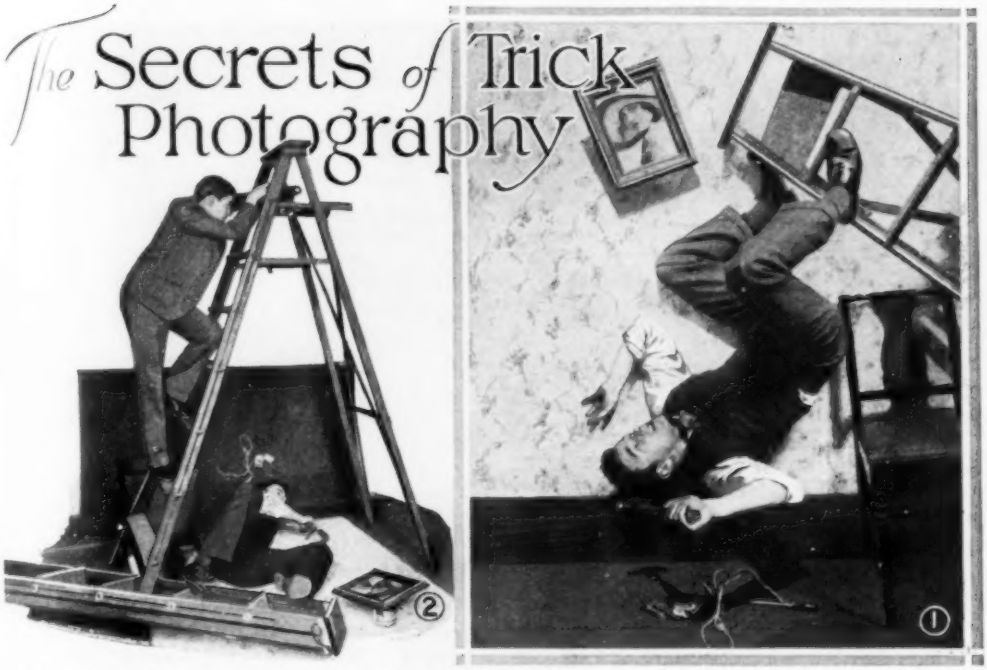
Here is a simple potato slicer that will save the housewife considerable time. Take any ordinary knife and clamp the handle to the kitchen table as shown in the photo. By pushing the potatoes against the blade, while holding the end of the knife steady with one hand, a potato can be sliced in less than half the time required to do it by hand.



Water Preserves Lead in Pail

After cans of red or white lead have been opened, it is often difficult to seal them tightly again to prevent drying out. This trouble can be overcome by scraping the sides of the can inside to remove the lead that has accumulated there and covering the lead with water, which is poured off when the lead is to be used.

The Secrets of Trick Photography



Extraordinary Photo Effects, Interesting Both to Take and to Look At, Can Be Produced by Any Amateur; the Background of Fig. 2 Gives the Illusion Shown in Fig. 1

BESIDES providing interesting pictures for your photo album, the making of trick snapshots furnishes considerable amusement.

A very amusing stunt and something quite different from the usual faked picture is the big "bust-up" shown in Fig. 1. Apparently, the subject is due for a violent crack on the head, but thanks to the camera, which sometimes lies, he is perfectly comfortable. You probably know all about it from looking at the dead giveaway in Fig. 2. The camera shoots down on the subject from the top of a step-ladder. The subject rests on three pieces of wallpaper, which have been carefully placed on the floor. The ladder, a picture and a chair are so arranged as to give the observer the illusion of the wall of a room. Various other bits of "property" are appropriately placed. A small rug with a package of cigarets, a box of matches, etc., is suspended on the real wall of the room, under the foot of the chair, which seems to rest on this false floor. Finally a piece of lumber is placed on the edge of the wallpaper to represent the baseboard. After the scene has been arranged, the cameraman takes his place, the subject assumes a horrified expression, and the shot is taken. Either flash powder, natural or artificial light may be used, and the scenery can be modified to allow a considerable variety of effects.

Another unusual trick picture, which is very simple of execution, is the two-headed girl in Fig. 3. It is a freak that would delight the heart of a Barnum. But in reality, the person is quite normal. The subject takes a position for writing, with her head and shoulders bent to the right, her left arm held close to her body and the hand concealed below the table, after which a picture is taken. Then, without moving the camera, the subject bends her head and shoulders to the left. She also reverses the relative position of her hands, placing the left hand on, and the right hand, below the table. A photograph of this second position is taken on the same film. With a little care in the placing of your subject, you should get an effect like the one shown. The taking of these photos may be done either indoors or out, but it is advisable to keep the background very simple, otherwise objects on the wall or in the scenery may show through and spoil the effect. Another

Grotesque Shots Like This Two-Headed Girl Will Make Your Photo Album Attractive

form of double, which if not quite so grotesque is equally amusing, is the one pictured in Fig. 4, which shows a girl conversing with herself.

These double exposures were made with an ordinary box camera, with the aid of the two-door box shown in Fig. 5. It is made from cigar-box wood. The outside measurements of the camera are taken, and the inside of the box is made just a trifle larger, so that one end, which is left open, will fit snugly over the front end of the camera. One side of this end should be made slightly shorter than the other three sides to provide clearance for the shutter trip. The opposite end of the box is fitted with two small doors, hinged and fitted snugly. The interior is painted a dead-black, after which it is ready for use. The subject is photographed in one position with one door open. When the first shot has been taken the opened door is closed while the other one is opened, and a second exposure made on the same film. The camera should not be moved at all during the whole proceeding, and should preferably be anchored securely to prevent it from shaking. The usual exposure time is allowed, and the finished picture will appear similar in make-up to those shown. Any number of varieties of this theme, a man about to shake hands with himself, boxing with himself, etc., can be done in a similar fashion. By holding the box so that the dividing line of the doors is horizontal instead of vertical, many other peculiar effects can be produced. You can mount the head of one person on the body of another; picture a tree growing from the waist-high figure of a man or you can photograph Barnum's original legless lady on a table. The exact method of producing likenesses of such monstrosities is merely a matter of taking two half pictures arranged to make a composite single photograph when the film is developed.

The making of black silhouettes on a white ground is a more or less familiar art to every camera enthusiast, but a variation of this effect is the white figure on a black background, as in Fig. 6. Select a good profile snapshot and cut it out neatly with a pair of scissors, as shown in Fig. 7. Take this cut-out to the dark room, where it is placed over a piece of sensitive photographic paper, as in Fig. 8, a small weight being used to hold the cut-out flat if it tends to curl. Make an exposure of about 20 seconds. Old photographs are not the only material that will serve to

A Photo, Which Blinks at You, Consists of Two Separate, Transparent Prints

make such silhouettes as practically any drawing or sketch can be attractively treated in the same manner.

An amusing little oddity in snapshots is the man with the blinking eyes. Take two portrait shots of the subject, one with his eyes open, and the other with them closed. No other part of the head should be moved in taking these two pictures, and the camera should also be kept in one position. Prints from the two negatives are thoroughly soaked and rubbed, on the back side, with a good grade machine or olive oil until they become quite transparent. Then they are pasted together at the top and bottom with a narrow strip of paper as in Fig. 9, with the "eyes-shut" print on top. Be sure to make the faces to coincide accurately, especially the eyes. Hold the assembly in front of a bright light, with the "eyes-shut" picture facing you. By pressing the two pasted ends together a little, so that the photos become slightly separated, and then releasing them, you will see the subject open and close his eyes in a manner that is quite deceiving and realistic. In many cases extremely humorous effects can be obtained by arranging prints in this way.

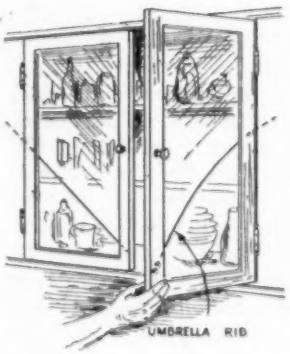
Silencing Rattles in Auto Gauges

When the glass which covers the dial on dash gauges becomes loose and rattles, do not attempt to take the gauge apart in order to remedy this condition, but run some shellac between the glass and the edge of the metal retaining it. This can be done with a small brush or a toothpick. If circular in shape, the glass should be turned around in order to spread the shellac evenly, as it can be run in only at the lower edge.

Renewing Typewriter Ribbons with Stamp-Pad Ink

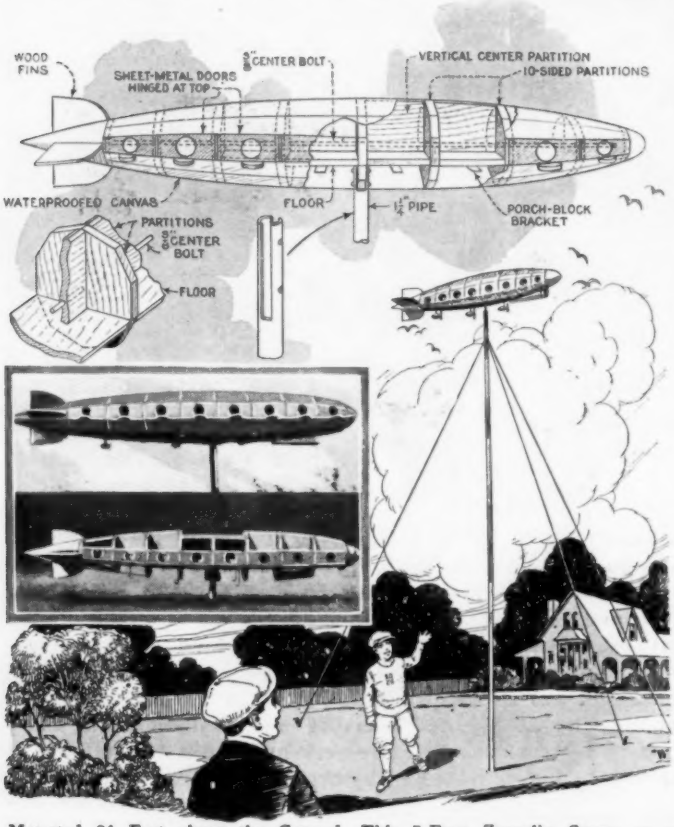
A typewriter ribbon that has become dim from long use can be restored by brushing stamp-pad ink over it while winding it up on one of the spools. Do not apply too much ink as it will then smear. Let the ribbon stand a while before using, so that the ink will be spread evenly over the surface.—Bennett B. Smith, Baldwin, Kans.

Umbrella Rib Keeps Cupboard Doors Closed



Cabinet doors can be made to close automatically with the aid of an old umbrella rib attached to the inside of the door and cabinet as shown. Staples are used to hold the rib. The tension on the rib will close the door as soon as you let go of it.

THIS MODEL ZEPPELIN PROVIDES A HOME FOR BIRDS



Mounted 24 Feet above the Ground, This 7-Foot Zeppelin Serves as a Weathervane Besides Being a Spacious Birdhouse

This Zeppelin-type birdhouse has a wooden framework and is covered with waterproofed canvas. To make the frame, cut nine 10-sided partitions from 1-in. stock. These vary in size from 12½ in. for the center one, to 6 in. for the end ones. A ⅜-in. hole is drilled through the center of each, and they are then threaded on a long ⅜-in. bolt. A vertical partition and a floor are added, which divide the ship into 16 compartments. The center partition is set in a deep slot cut in the end of a length of 1¼-in. pipe, which projects a few inches below the ship, so that it can be set on the end of a mast upon which it can turn freely in the wind to serve as a weathervane. The center bolt passes through holes drilled in the projecting lips of the pipe, while another shorter bolt holds the center partition to the pipe in the same way. Sheet-metal doors are provided for each compartment to make it accessible, each door having a cut-out to allow the passage of birds. Small brackets are extended outward from the frame to hold porch blocks for the birds to alight on. Both the nose and tailpiece are made up of blocks of wood, cut to shape, and wooden fins are screwed to the tailpiece, after the canvas covering has been stretched over the frame. If desired, a wooden passenger cabin and five small gondolas, made of large spools and provided with aluminum propellers, can be added. The canvas covering should be waterproofed with two coats of spar varnish followed by a coat of aluminum bronze. The ship shown here was made 7 ft. long and was mounted on a well-braced pipe mast, which held it about 24 ft. above the ground. The pipe nipple on the ship extends 2 or 3 in. over the mast, which in turn, butts up against a bolt passing through the nipple.—Roy J. Chivens, Cameron, Mo.

Auto Generator Runs Pump

On cars that have their water pumps connected directly to one end of the generator, the breaking of a fan belt is not so serious as it might be because the generator can be used to run the water pump. To do this, merely remove the cover from the generator cut-out—the little black box on the top of the generator. Inside are a pair of breaker points. Bringing the points together will run the battery current into the generator, and will make it operate like a motor. A broken match can be used as a wedge to hold the points together. The current required is only a little more than that needed to run the headlights.

and therefore this method can be used with safety for a limited period.—C. A. Packer, Chicago.

A Remedy for Mildew on Rose Bushes

For curing powdery mildew, a common disease of rose bushes, which is indicated by small ash-colored spots on the leaves, use a mixture consisting of sulphur, 1 part, and lime, 5 parts. This should be dusted on the plants twice a week in the afternoon and washed off the following morning. The treatment is also effective in combating the disease on lilacs, zinnia and other plants.

Hook Prevents Ladder from Slipping

When ladders are used on cement walks and drives, greater safety against slipping can be obtained by the use of a hook which anyone can easily make from a length of iron rod. One end is bent over at right angles and ground to a point. It should be at least 6 in. long and is driven into the ground, while the other end is bent over to form a "U", which is slipped over the lowest rung of the ladder. This holder has been found effective when used in sod or hard soil but cannot

Iron Hook Driven into the Ground Keeps Ladder from Slipping on Cement Walk

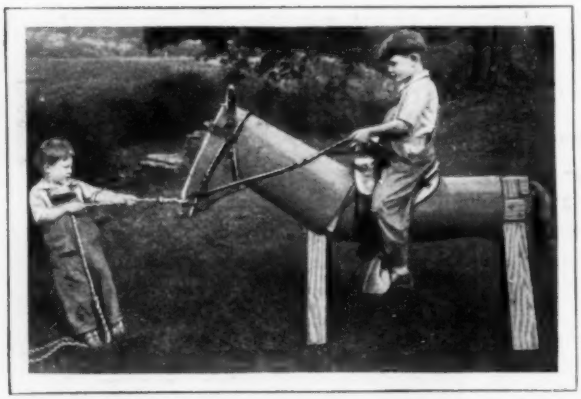
be relied upon when hooked in loose sand. —A. L. Kaser, South Bend, Ind.

Boys Can Have Spirited but Harmless Battles with a Number of These Rubber-Band Guns

Boys' Rubber-Band Machine Gun for Backyard Warfare

Using old packing boxes as machine-gun nests, boys can have some spirited but harmless battles with a number of rubber-band machine guns made as shown in the illustration. A piece of ¾-in. wood is cut about 6 in. wide and 12 in. long. It is provided with a handle made of broomstick, which is glued and driven into a hole drilled for it in the center. A piece of wood, 6 in. long and 1½ in. square, is nailed to one end, and a number of spring clips are screwed to this piece so that one jaw is stationary and the other movable. A rubber band is slipped over the movable jaws of the clips and the piece to which they are attached, in order to increase the pressure, two or three nails being used to hold the band in place. The ammunition consists of rubber bands, ¼ in. wide, cut from old inner tubes. Each band is held at the muzzle end by slipping it over the end of a finishing nail, and inserting the other end between the jaws of a clip. Sights of small finishing nails are driven into the top for better aiming.

¶For removing fruit-jar covers, use a piece of inner tube in the hand.



Outdoor Play Horse Can Be Made from Carpenters' Wooden Horse and Roofing Paper

Making a Play Horse

Any wooden carpenters' horse can be transformed into an attractive play horse by nailing on a wooden frame to represent the neck and head, at one end of the horse, and then cover the body, neck and head with pieces of heavy tar or roofing paper rolled over and tacked as shown in the photo. Strips of the same material are cut to form the ears, and a suitable tail is provided. A few scraps of leather harness or belting are used to make the bridle and the saddle, which may even be fitted with stirrups to please the boys still better.—Rene Bache, Washington, D. C.

Backstop Holds Books in Line in Bookcase

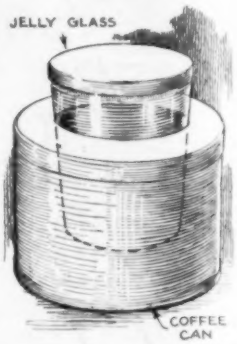
When your bookshelf is too deep for a set of books, and they may be pushed back too far to be easily removed, use a backstop as shown in the drawing. It consists of a piece of 1 by 4-in. wood cut to fit across the inside of the case, directly behind the books. When these are lined up along the front edge of the shelf, the distance between the stop and the back of the case is measured, and cleats, cut to fill this space snugly are nailed on to keep the stop in place. This will also make the shelf look orderly.

To Write on Glass

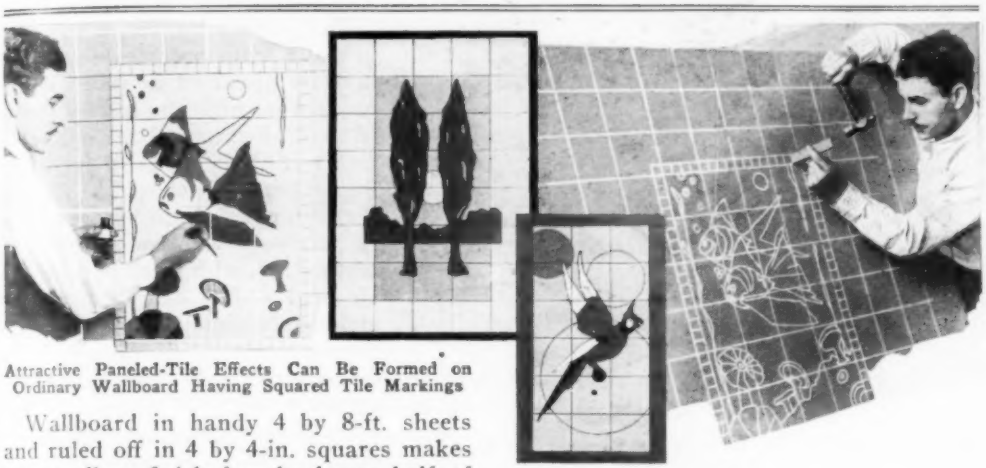
To write with ink on glass, prepare it as follows: First wash the surface with a good cleaning powder, rinse with water, then rub dry with crumpled newspapers or paper towels. Next prepare a varnish of dammar gum, 8 grams; gum mastic in sheet form, 5 grams, and alcohol, 80 grams. Dissolve the gums in the alcohol and filter, then keep in a tightly corked bottle. The varnish is brilliant, hard and transparent. To apply it, hold the glass in the left hand and pour some varnish in the center. Tilt the glass quickly in all directions to spread the varnish evenly. Drain the surplus into the bottle from one corner. Never brush the varnish on, as an even coating cannot be obtained in this way. The liquid dries quickly and forms an excellent surface for inks.—J. C. Tobias, Bethlehem, Pa.

How to Keep a Drink Hot

When necessary to keep a drink hot for several hours, try the following method: Get a 1-lb. coffee can and a jelly glass, each having a cover. Cut an opening in the lid of the can to receive the glass snugly as shown in the drawing. Heat the liquid to be kept hot, to the boiling point, pour it into the jelly glass carefully, taking the necessary precautions to prevent it from cracking due to too sudden application of heat, and then pour boiling water into the coffee can through the opening in the lid, which is pressed on tightly. Replace the lid of the glass and set the glass in the opening of the coffee can. You will find that the liquid will be kept hot for five or six hours.

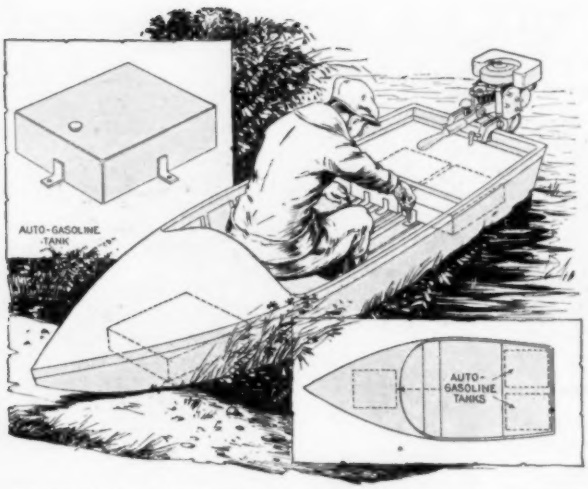


IMITATION PANELED TILE FOR BATHROOM FINISH



Attractive Paneled-Tile Effects Can Be Formed on Ordinary Wallboard Having Squared Tile Markings

Wallboard in handy 4 by 8-ft. sheets and ruled off in 4 by 4-in. squares makes an excellent finish for the lower half of the bathroom, kitchen, hall or, in fact, any room. It gives an imitation-tile effect which, when embellished with suitable designs, will greatly improve the appearance. The hardness of the average paper wallboard is not so great but what decorative design can easily be marked into the surface with a round-pointed hardwood stick. Select a fairly large expanse of wall where the plain tile effect of the manufactured board might prove monotonous. To relieve this, a panel may be centered in it, using some design in keeping with the nature of the room. The squared lines in the photos indicate the regular 4-in. tile markings of the wallboard, so it is easy to outline the picture. After the pencil sketch has been made, take a smooth, round-ended stick, such as a penholder, and with firm pressure, go over the lines of the picture so that the stick will leave a fairly heavy mark, as shown in the lower detail. All straight lines are followed by drawing the marking tool along a straightedge. The curved lines are then made free-hand. Any hard places in the board, which will not pack down to form a depression, may be made by tapping on a round-ended stick of the proper width, as shown in the upper right-hand detail. This method is especially useful to form short lines which are repeated throughout the design. The general effect, when completed, is a picture incised in tile blocks. Care must be taken, however, to keep the lines the same depth as the tile markings. The board may be nailed or cemented into place on the wall and painted an over-all color of, say, light cream, or the painting job completed before the board is fastened. At any rate, after the base coat has dried, the various colors for the panel can be painted in and, after they have dried, the various tile markings striped in black with waterproof india ink. This is best done with a ball-end pen of a size to neatly fill the tile markings. Finally a coat of spar varnish is applied over the painted surface to provide an even glossy finish. Two simple panels, which are suitable for either kitchen or bathroom, are shown in the center details. Where a whole panel is not practical, different squares may be paneled to form a uniform effect, such as merely two diagonal lines on alternate squares. In producing repeats of very small designs, time and effort can be saved by making a wooden form to exact size from round-edged strips of lumber. This is then used with a hammer. A stop block can be devised to make the lines all of uniform depth. Such paneled-tile effects greatly enhance the appearance of a room.



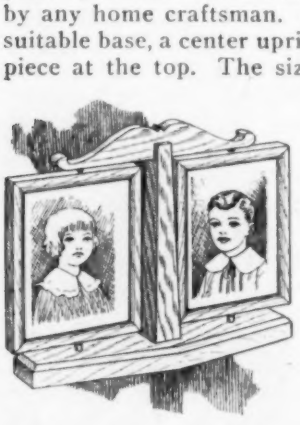
Discarded Auto Gasoline Tanks Make Excellent Air Chambers for Small Boats

Auto Gas Tanks Make Small Boats Unsinkable

To keep small boats afloat if overturned, two or three auto gasoline tanks will prove effective. Angle braces, soldered to the outside of the tanks, are screwed to the floor or sides of the boat to keep them in position. Tanks used under the front seat of model-T coupes are especially suitable for this purpose. They must be airtight and their outlets soldered shut.

A Duplex Frame for Photos

For holding a pair of small framed photos, the illustrated frame can be made by any home craftsman. It consists of a suitable base, a center upright and a crosspiece at the top. The size of the frame, of course, depends on the size of the photos it must accommodate. In the center of the top and bottom members of the photos a small hole is drilled to fit dowels projecting from the base and upper crosspiece of the frame, so that the pictures can be turned at any desired angle.



Etching Solutions for Copper and Other Metals

For etching copper, a solution is made from perchloride-of-iron crystals dissolved in water in an earthen jar until the mixture tests 38 to 40° Beaume. The same solution testing 35° is good for etching on brass. It should be filtered through cheesecloth before using. A perchloride-of-iron solution, testing 35°, with some hydrochloric acid added, can be used for etching aluminum, the proper proportions being 2 lb. of iron in 40 oz. of water with 2 oz. of hydrochloric acid. A 40° solution of the same kind is good for steel etching. Another solution for this purpose consists of 5 parts of acetic acid and 1 part of fuming nitric acid diluted with distilled water until the etching is reasonably rapid. In making these solutions, do not neglect the precautions to add the acid, drop by drop, to water; never water to acid.

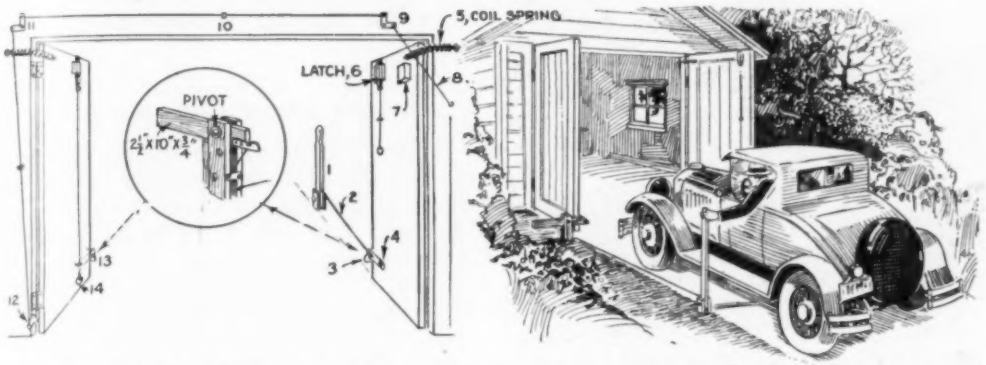
Paintbrush Holder and Covers Made from Paper

When a small can of shellac or paint is used frequently, so that the brush must be kept in the liquid, a corrugated cardboard holder for it will serve to keep dust out. It also prevents the brush from drying.

How to Preserve Leather Bindings

Leather bookbindings can be kept in good condition for many years by applying a dressing made of equal parts of neat's-foot and castor oil. The oil may be rubbed into the leather by hand or with a soft cloth. After the treatment, the books should be placed in a warm room for a day or two. The dressing should be applied when the books are new and treatments repeated about every 2 years.

THESE GARAGE DOORS ARE CLOSED FROM YOUR CAR



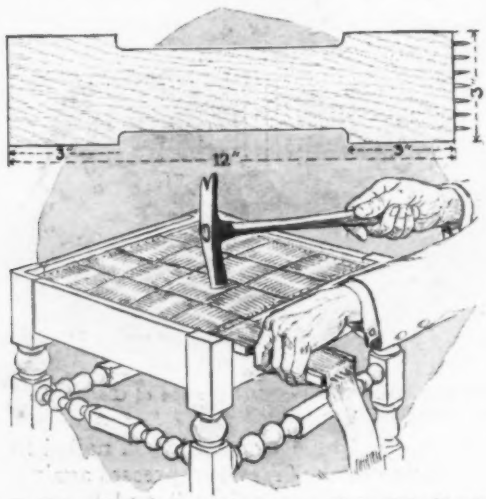
Those Who Are in a Hurry to Get Out of the Garage Will Appreciate This Practical Method of Closing the Doors Automatically without Even Getting Out of the Car

A practical device that will automatically close your garage doors, without the necessity of getting out of the car, can be made from a few pieces of flat iron, angle braces and wire. The installation shown here was designed for double doors swinging outward. Spring latches are installed at the top of both doors to lock them when closed, which is done by means of screen-door springs. Catches, shown in the circular insert, are arranged to hold the doors open while backing the car out of the garage. One of these is released by a lever (detail 1) made from a 3-ft. length of broomstick, with a hole drilled at one end and pinned to a notched post set in the ground about 1 ft. from the driveway and about 12 ft. from the garage door, where it can easily be reached by the driver when backing out. Attach a wire (2) to the lever about 3 in. above the pivot, and run the wire to the catch (3) which holds the door on that side. The catch is attached to a 1 by 3-in. length of wood which serves as the counterbalance, the whole assembly being pivoted on a second post set in the ground. The catch is notched to fit a flat-iron plate screwed to the inside of this door. A similar plate on the other door is screwed to the outside, as the second door closes last, and the plates must be so arranged that they will not interfere with each other. Drive screweyes into the door jamb at points 8 and 10, and pivot angle braces at points 9, 11 and 12, running wire such as heavy picture wire between these points as indicated, the wire being securely tied to screweye 8, but threaded through screweye 10. A 2 by 4 by 4-in. block, nailed to the inside of the first door, presses against the wire between points 8 and 9 when the door closes. This pulls the rest of the wiring, which runs to catch 13 on the second door and releases it in the same way as the first. In operation, the first door is closed, which releases the second one and allows it to close also. The coil springs should be adjusted to the proper tension for closing the doors, so that the latches (6) will lock. A hole, drilled in the second door, directly under and in line with the latch at the top, will enable you to attach a string to the latter and release it from the outside.—R. B. Black, Los Angeles, Calif.

Coconut Head Stores Twine

A coconut, a piece of a bandana handkerchief, two brass rings and a roll of twine are used by a clever housewife to make a decorative holder for the ball of twine that so often is needed in the kitchen. The eyes and mouth are painted on and a hole is drilled through the mouth. The holder may be screwed to a suitable wooden base or hung on the wall.

A Tool for Stretching Webbing



It Takes Only a Few Moments to Make This Handy Tool for Stretching Webbing

When it is necessary to stretch webbing over a footstool or other piece of furniture, the illustrated tool will be helpful. It is made from a 12-in. piece of wood, about 3 in. wide. Three or four eightpenny nails are driven in one end so that the ends project about ½ in. The heads are cut off and the ends sharpened with a file. In use, the nails are pushed through the webbing and the other end of the tool butted against the side of the chair so that the webbing will be held tight while it is being nailed. In order to avoid marring the finish of the furniture, it is advisable to slip a rubber band over the end of the tool and tack it to the sides.

Rubber Guard Protects Wood When Driving Nails

To protect wood while driving nails, a piece of rubber, cut from an old inner tube, having a hole in the center and slipped over the nail, will prove effective. After the nail has been driven well down, use a nail set in the usual manner. The rubber is so efficient a shock absorber that blows of considerable force can be struck with the hammer without marring the wood.

Dividing a Small Circle Accurately

When it is desired to lay out divisions on a small circle with accuracy, it is sometimes rather difficult to do the work with dividers. Lay out a circle as large as possible, concentric with the one to be divided. Then divide the large circle into the required number of equal parts and draw lines to the center with a straightedge. This will divide the small circle in the same number of parts as the large one. It is easier to work on a large scale, and any errors in making the large divisions will be greatly reduced in the small circle, though, of course, the proportions will remain the same.

An Instant Cigaret Extinguisher

A cigaret can be instantly extinguished without crushing it by inserting the lighted end into one of the holes of a glass or porcelain flower holder purchased at any 5 and 10-cent store. The cigaret fits snugly into these holes, and the action cuts off the air supply to the burning tip and puts it out.

How to Make Model-Ship Rails

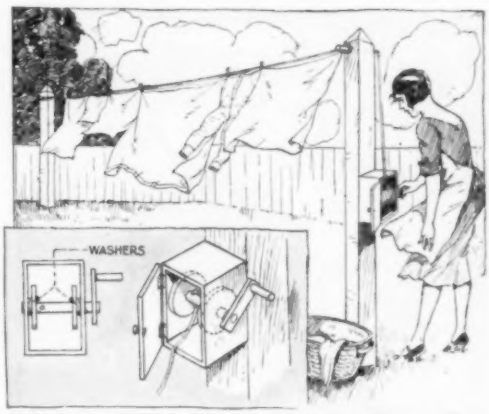
On most models, the forecastle and quarterdeck rails are formed by a top horizontal rail, supported by regularly spaced posts that are fastened to the deck. An equally decorative and rigid rail can be made without steaming and bending the horizontal rail and individually turning the supporting posts. To do this, extend the hull upward to the height the rail would be, then hollow out the hull block to the depth of the deck level. This leaves

a solid rail of proper thickness around the outside of the deck. With a pair of dividers, space off locations around the rail top, and drill small vertical holes through the depth of the rail and into the hull proper. Now decide how deep the horizontal rail will be, and scribe a line around the rail circumference at this point. Scribe another line the same way exactly at deck level. End both lines about amidships, leaving enough stock to form an ornamental post. Then saw just inside of both lines down to these posts, and cut away all stock between them. This leaves a top rail supported only by the two posts on the inside ends. For the other posts, use glass or wooden beads, as many as required, to fit between the top rail and the deck, and fasten in place with needles or stiff wire, driven through the holes in the top rail, through the beads and into the corresponding holes in the deck.

An Elevated Campfire Is Handy

Tired of stooping over while preparing his meals on a campfire, an Oregon woodsman uses an elevated campfire consisting of a cribbing of short logs with a floor of saplings across the top. A layer of rocks and earth on the flooring holds the fire and reduces the possibility of its spreading. A suitable cross pole is placed in crotches of two saplings set in the ground, to hold the cooking vessels.

By Building the Campfire on a Cribbing of Short Logs, Cooking Can Be Made Much Easier



This Crank-Wound Reel, Inclosed in a Wooden Box, Will Keep Your Clothesline Clean and Handy

Inclosed Reel Keeps Line Clean

It will be found much handier to reel up your clothesline than to remove it in the usual way. Besides, by installing the reel in a wooden box permanently fastened to the post, the rope will be kept clean. A double line, suspended around the tops of two posts and laid over projecting dowels, is a convenient arrangement. The end of the line is tied to form a loop which is hooked over a dowel. The construction of the box and reel is shown in the detail. A suitable wooden crank fits holes drilled through the sides, while wooden disks form the sides of the reel, these being driven on the crank. Washers are used to keep the reel from rubbing against the inside of the box, while a cotter pin at the end of the crank prevents it from being pulled out of the box.—B. L. Filozof, Buffalo, N. Y.

How to Obtain Sharp Focus When Enlarging

When enlarging, trouble is often experienced in obtaining the sharpest focus for the projected image. The task can be simplified by ruling an overexposed or dense black negative with a sharp razor blade so that the lines cut will allow the light to pass through, enabling one to focus them sharply. If the lines are vertical and horizontal, they will also assist in truing the paper holder.

¶Fresh flowers may be preserved almost indefinitely by dipping them in a solution of collodion, thinned with ether.

For Threading Pulleys in Places Hard to Reach, a Length of Pipe Will Prove Helpful

Pipe Guides Rope over High Pulley

Instead of using a long ladder, which is not always at hand, try this trick the next time you find it necessary to replace the rope over a high overhead pulley, and you will find the job comparatively easy. Farmers, for instance, will find this method highly useful for rethreading hay-rope pulleys. Get a pipe of suitable length and of a size that will let the rope slip inside. Without kinking, bend one end of the pipe so that it faces the pulley when the pipe is raised. Then slip the rope up through the pipe as shown in the drawing. After threading the pulley, keep on feeding the rope until the end can be reached from the ground.

Poor Insulation of Ignition Wires Affects Motor Performance

If your car has a peculiar jerk or lacks pep, and the cause cannot be found, a check on the ignition wiring may reveal the trouble. On a dark street or in a darkened building, watch the high-tension wiring while the engine is suddenly accelerated. Rubber insulation on ignition wire usually deteriorates rapidly and will then allow a leakage of current. There will probably be a blue glow along the wiring under normal conditions, but if the glow is conspicuously brighter at any particular place, such as a bend near metal, or if sparks jump from the wiring, the insulation is defective. The loss of current robs the plugs of some of the electrical energy essential to smooth motor performance.

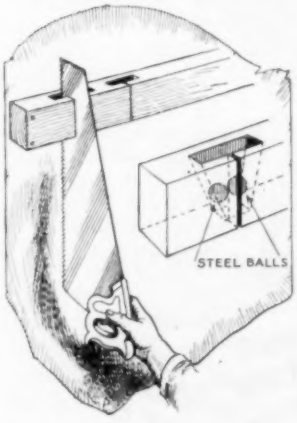
A Dropcloth for Kitchen Workshop

Using an old sheet or other large cloth to cover the floor when one has to use the kitchen as a workshop, is a practical idea borrowed from painters, who use such cloths to protect furniture and floors. The cloth will catch shavings and filings, and will save much time in cleaning up after the work is done.

Black Dirt Melts Snow Quickly

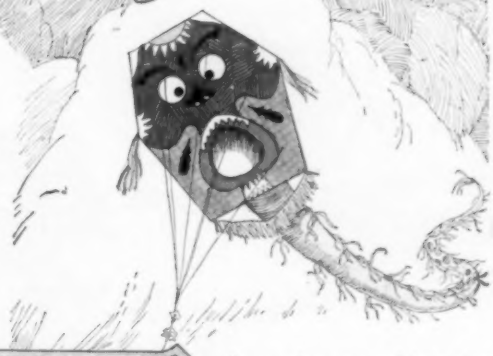
An easy way to melt snow in the spring for planting the garden, or for other purposes, is to sprinkle black dirt over it. The dirt absorbs heat from the sun instead of reflecting it like snow, and this hastens the melting. United States forest-service workers have found this method enables them to plant their nurseries earlier.

Hanger Holds Saw Securely



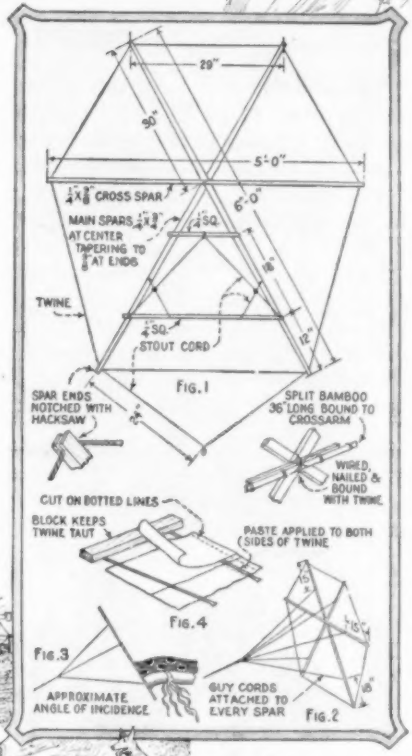
Handsaws can be conveniently held by a hanger made from a length of 2 by 4-in. stock. Mortises with two sides beveled are cut to accommodate two steel balls, and a saw cut is made through the center of the mortise to receive the saw. The saw is pushed up in the slot between the balls. A slight downward jerk causes the balls to pinch the blade, holding it in position.

A Flying Dragon Kite

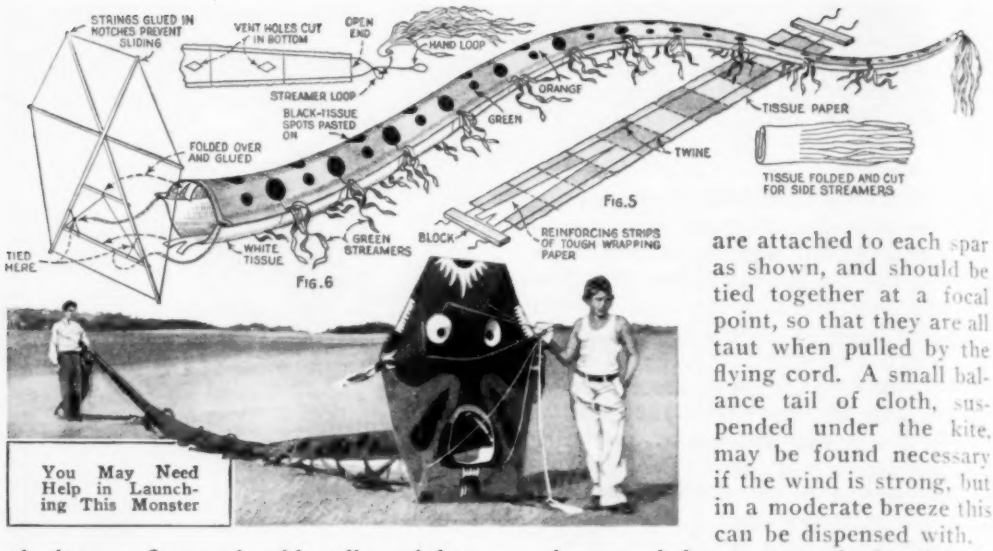


WRITHING about high in the air, this huge dragon kite will attract considerable attention, and can be seen with its 50-ft. tail for several miles. Any boy who can hold the kite, and has enough weight to hang on to it when in the air, can fly it, but he will have to get the help of two friends to launch it into the air.

The frame of this kite is the familiar X-type, comprising two main spars with a lighter cross spar all joined together a short distance above the center as shown in Fig. 1. Spruce is preferable for the spars although any other tough straight-grained wood will also serve the purpose. The main spars are ¼ in. thick and ¾ in. wide where they join, tapering to ⅜ in. at the ends. A ¼ by ⅜-in. piece is used for the cross spar, and is reinforced with a 36-in. length of split bamboo bound with twine at the center, allowing flexibility without risk of breaking. The ends of each spar are slotted to receive the string to which the paper is pasted. Fishline or heavy twine is suitable for this purpose. Below the center of the frame, two crossbars of ¼-in. square spruce are attached to carry the body, or serpentlike tail, made of tissue paper. Where twine is used for binding, glue is also applied so that the twine will not slip. Cover the frame with tough wrapping paper, lapping the edges and pasting with glue or mucilage. The decorative effect is obtained with pieces of colored tissue paper, as shown in Fig. 7. An opening, representing the mouth, is cut to permit air to enter the body.



Select a clear, calm day for making the body in the open, as it is too long to be handled conveniently indoors. It can be made up on a sidewalk swept free of dirt, as shown in one of the photos. Paste together, edge to edge, as many 20 by 30-in. sheets of tissue paper as are necessary to make the kite the desired length. White tissue is used for the bottom, and alternating orange and green for the top, as indicated in Fig. 6. Lay



You May Need Help in Launching This Monster

the bottom flat on the sidewalk, and draw two strings taut over them, tapering toward the tail and held in place by blocks, as in Fig. 5. Paste the top section to the bottom as you go along to get the string in the seam, Figs. 4 and 5. A long strip of tough wrapping paper, cut to a V-shape, is pasted to the front end to reinforce it. Similarly a piece of the same paper is used to reinforce the edge of the front opening. These reinforcing strips are applied before the top and bottom sections are pasted together. After the glue has dried along the edges of the body, trim away the waste about ½ in. from the string, which completes the body except for the streamers on each side and the long tail streamer cut from the waste strips. The longer this tail is, the better, as it helps to balance the kite. Fig. 6 shows the method of fastening the body to the kite, using glue on the twine and tying it securely. Guy cords are attached to each spar as shown, and should be tied together at a focal point, so that they are all taut when pulled by the flying cord. A small balance tail of cloth, suspended under the kite, may be found necessary if the wind is strong, but in a moderate breeze this can be dispensed with.

A crew of three are required to launch this sky monster, as shown in the detail across the bottom. Flying is really as easy as with an ordinary small kite, once it is off the ground and clear of obstructions. Select an open field for the try-out; otherwise a tree or telephone wire may wreck the kite.

Another type of serpent kite is shown in Figs. 9, 10 and 11. It is somewhat harder to fly and launch than the dragon, as it is made up of a series of kites strung together at exactly the same angle of incidence, or slant, toward the wind. First make a series of kites of the design shown, each 1 in. smaller than the next preceding one. Twelve were used for the serpent illustrated, the first having 24-in. spars and the last 12-in. spars.

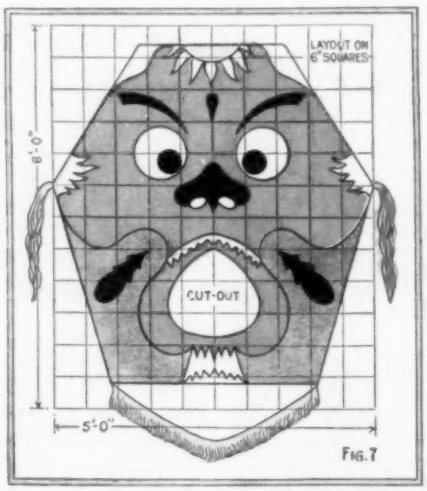
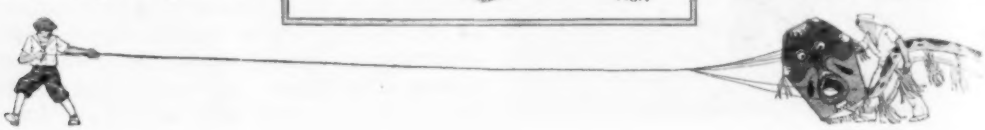
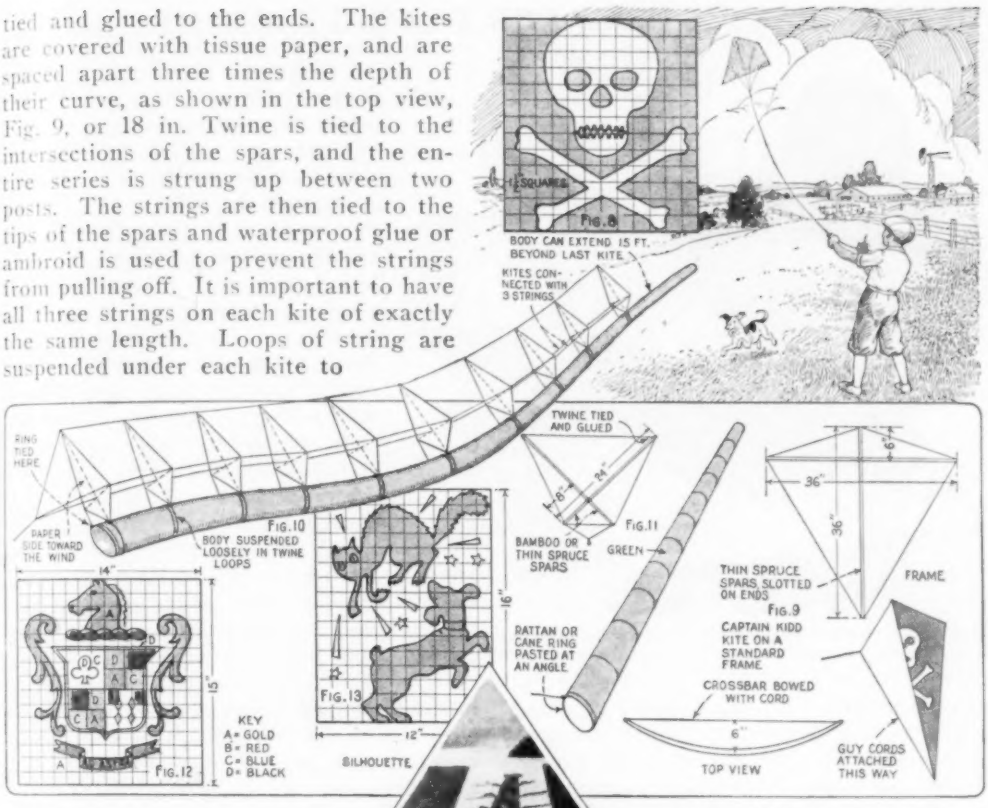


FIG.7

Bamboo may be substituted for spruce. As the spars are necessarily of small cross section, the outline twine must be



tied and glued to the ends. The kites are covered with tissue paper, and are spaced apart three times the depth of their curve, as shown in the top view, Fig. 9, or 18 in. Twine is tied to the intersections of the spars, and the entire series is strung up between two posts. The strings are then tied to the tips of the spars and waterproof glue or ambroid is used to prevent the strings from pulling off. It is important to have all three strings on each kite of exactly the same length. Loops of string are suspended under each kite to carry the serpent body loosely, so that it can equalize between the kites with variations of wind pressure. Green tissue paper is used for the body. It should be about half the girth of the dragon body, and the tail may extend about 15 ft. beyond the last kite. A ring of rattan or cane of small diameter is pasted inside the forward end at an angle, as shown in Fig. 11, and tied under the leading kite.



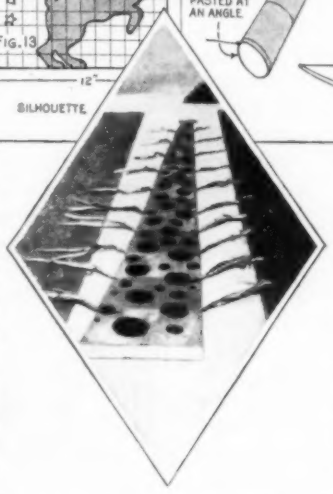
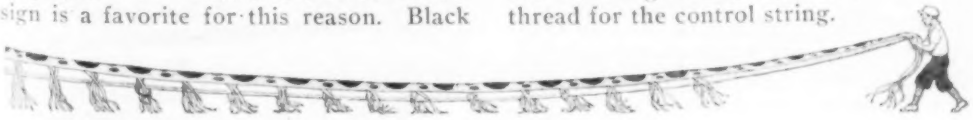
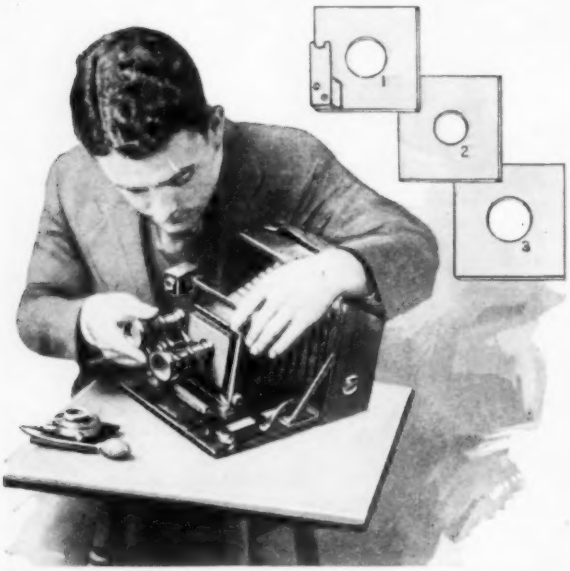


Fig. 9 shows a familiar type of kite and suitable designs for decorating kites are presented in Figs. 8, 12 and 13. A black silhouette against a white background stands out distinctly at a considerable height, and the skull-and-crossbones design is a favorite for this reason. Black tissue, folded once and cut according to the squared outline shown, will make a very piratical-appearing emblem above the housetops. The cat-and-dog silhouette is also effective at moderate altitudes. The coat-of-arms requires more work, but makes a neat design in the colors indicated, which are cut from separate pieces and pasted on.

Small novelty kites, that are excellent performers and require only a scant breeze to send them soaring, can be modeled after the larger ones of the familiar type. In making such small kites, 6-in. broom-straws have been found suitable for the cross spars, waxed sandwich paper for the covering and a fine silk thread for the control string.



OPERA GLASSES USED FOR TAKING DISTANT PHOTOS

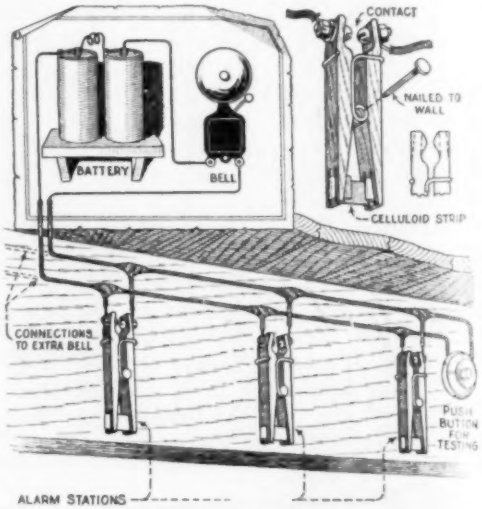


Long-Distance Photos Can Be Made to Resemble Close-Ups by Using Opera Glasses on Your Camera

Amateur photographers whose cameras are not equipped for taking long-distance photos, may use ordinary opera glasses as a substitute for a telephoto lens. The first step is to nail together three squares of cigar-box wood to form a lens board for the camera, as the regular board must be removed. The bottom board is perforated with a hole somewhat larger than the eyepiece of the opera glass, the middle board a hole a trifle smaller than the eyepiece, and the third, a hole to accommodate the eyepiece. A suitable bracket is nailed to the lens board to form a support for the glasses. In use, the lens board is substituted for the regular unit, the glasses are fitted in place snugly and the outfit is ready for taking long-distance shots. A little experimenting will show how to obtain a sharp focus on the ground glass. In some cases, it may be necessary to focus on some object farther away than the one that is to be taken, in order to get a clear picture. As the regular camera shutter has been removed with the lens board, a substitute may be employed in the form of a cap or piece of cloth held over the end of the glass while the plate cover is removed, and taken away for the exposure. In case film-roll cameras are used, a tight-fitting cap should be adjusted over the end of the opera glass. The outfit is not difficult to make.

Cheap Electric Fire-Alarm System Affords Adequate Protection

This electric fire-alarm system can be made in a short time by utilizing a few spring-type clothespins, a couple of dry cells, an electric bell, and celluloid strips cut from old photo films. Each clothespin is provided with two contact points consisting of short screws slipped through holes drilled in the top of the jaws. The screws are held in place with nuts, which also serve to clamp the connecting wires. The other ends of the pin are split lengthwise with a knife for about half of their length to hold strips of celluloid, which keep the jaws apart. Mount the pins on the walls throughout the house over such places where a fire might possibly originate, by driving a nail through the coil spring between the jaws. All pins are

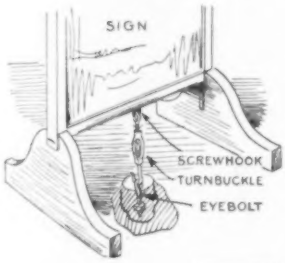


Although the Cost of This Fire-Alarm System Is Negligible, It Insures Adequate Protection

connected in parallel with each other and in series with the battery and bell, as shown in the wiring diagram. If one bell cannot be heard at all points of the house, it may be advisable to use two, both being wired in parallel. To test the system frequently, a push button should be connected across the line at the alarm station most distant from the battery. If photographic film is used for the celluloid strips, the coating must first be removed from both sides by soaking for a few minutes in warm water. This will insure quick ignition.—Eugene Emerson, Jackson Heights, N. J.

Fastening Portable Signs to Sidewalk

To prevent the wind from overturning or moving a portable sign, the arrangement shown in the drawing will prove effective. A screweye was driven into the bottom edge of the sign and an eyebolt imbedded in the sidewalk. The eyebolt should be flush with the walk so that it will not trip pedestrians when the sign is removed. A small turnbuckle connects the screweye and eyebolt and holds the sign down securely when it is drawn up tightly.—J. R. Minter, Whitewater, California.



Tobacco Dust Added to Mash Kills Poultry Worms

Poultry worms can be exterminated by adding finely powdered tobacco dust to the dry mash, in the proportion of two per cent of tobacco dust, by weight, to the quantity of mash. This mixture should be fed for three or four weeks and then repeated at three-week intervals until the worms are entirely eradicated.—E. G. Moore, Washington, D. C.

Garments that have been accidentally scorched should be laid out in the sunshine with the scorched portions fully exposed; light scorches will come out entirely and bad ones will be bleached.

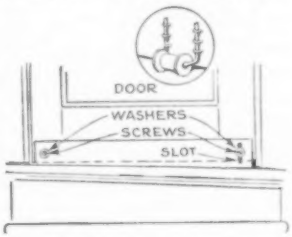
A Slotted Trough on Sawbuck Supports Work Properly and Prevents Pinching of the Saw

This Sawbuck Will Not Pinch

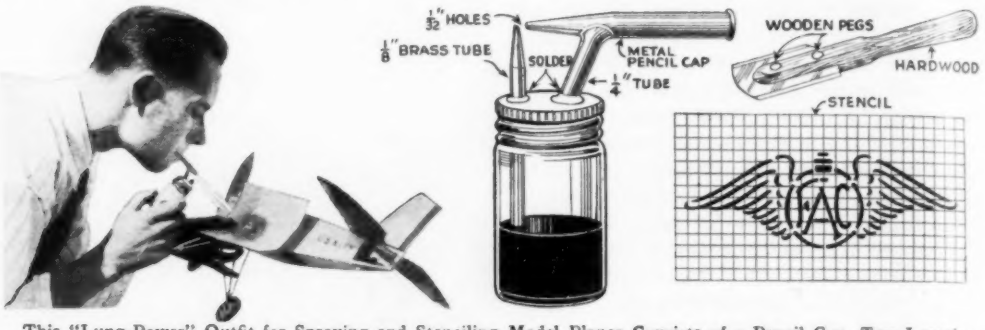
Saw blades often need resetting after the teeth have been pinched between the work on a sawbuck of the usual type. The pinching can be avoided by making a sawbuck with a shallow trough, slotted halfway through its width at the center, to permit the passage of the saw as shown. The work will not pinch because it is supported for the entire length of the sawbuck.

Weatherstrip on Door Adjusted Automatically

Dropping down flat on an inclined porch floor, the illustrated weatherstrip has been found to keep out drafts effectively. It consists of a strip of 1-in. wood, pivoted at one end to the bottom edge of the door by means of a wood screw. The other end is slotted to allow vertical movement, and is held onto the door loosely with another wood screw. Both screws are provided with washers. A small caster or roller, such as a spool, is attached as indicated in the detail, near the slotted end of the strip, so that it will ride over the porch floor without scraping.—L. T. Schiff, New York City.



A SPRAY AND STENCIL OUTFIT FOR MODEL PLANES

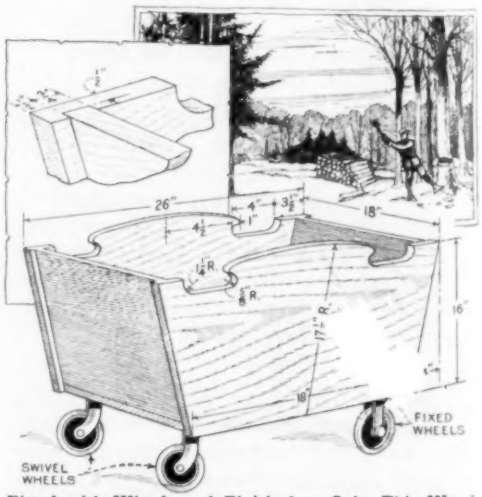


This "Lung-Power" Outfit for Spraying and Stenciling Model Planes Consists of a Pencil Cap, Two Lengths of Copper Tubing and a Screw-Top Glass Jar

Unquestionably the best method of painting model planes is to use a spraying apparatus. An efficient "lung-power" sprayer can be made for almost nothing, and the only tools needed are a soldering iron and a file. Get a small screw-cap glass jar, not over 2 in. in diameter and 3 in. high. Larger jars are not so easy to handle. Perforate the top at two points for the blowpipe and paint-supply pipe. The former consists of an ordinary metal pencil cap, purchased at the 10-cent or stationery store. A short piece of ¼-in. brass or copper tubing is filed so that it can be soldered to both the pencil cap and lid, as indicated in the drawing. A 1/32-in. hole is drilled in the tip of the cap. The paint tube is made of brass tubing, having an inside diameter of ⅛ in., and a length that will allow it to be extended from the drilled end of the pencil cap to ¼ in. from the bottom of the jar. The top end is plugged with solder, a 1/32-in. hole being drilled through this and the end then filed to a taper. The extreme tip should be slightly beveled to face the air nozzle. Be sure that the two tips are properly alined, so that the air current will strike directly against the tip of the paint nozzle. In use, it has been found that best results can be obtained with brushing lacquer, cut down about one half with thinner. Using stencils for lettering and emblems insures neat work. These can be laid out easily and accurately on squared paper sold at stationers'. Cut the stencils out with a safety-razor blade held in a slotted wooden handle with two tapered wood pegs, which can be driven out when a new blade is required. By holding the stencil tightly against the work, a first-class job of lettering can be done without getting the paint on the fuselage or wings where it is not wanted.

A Neat Rubber-Tired Woodbox for the Fireplace

The woodbox shown here eliminates much of the labor of tending to a wood fire in the grate. Rubber-tired wheels enable it to be moved with little effort, and its good lines render it rather attractive. To make it, use 1-in. stock, preferably surfaced pine or fir, sanded on one side. After the top of the sides have been laid out with the use of a paper pattern, they can be cut with a fretsaw. Nail together with six-penny finishing nails, spaced 3 in. apart, and mount the box on two fixed

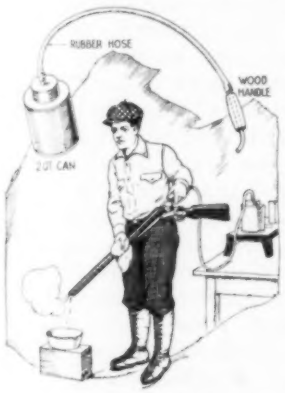


Fitted with Wheels and Finished to Suit, This Woodbox Looks Well near Any Fireplace

4-in. rubber-tired wheels at one end and two swivel wheels at the other. Coat the inside with linseed oil and then sandpaper and lacquer the outside, or finish to match other furniture in the room.

Cleaning Firearms with Steam

Firearms should be kept scrupulously clean to prevent corrosion and to prolong their life. Hot water is an excellent cleaner, but steam is better. A simple device for applying the steam can be made as follows: Solder the lid to a 2-qt. can; then punch a hole through the lid and solder a 2-in. length of brass tubing into the hole. About 5 ft. of rubber tubing is fitted over this nipple. The other end of the tubing also is provided with a brass nipple and with a wooden grip to protect the hand against the heat. In use, water is poured into the can and set to boil until plenty of steam is produced. Then take the gun barrel in one hand, holding it with a folded cloth, and insert the nozzle as shown. A few minutes of this treatment removes every trace of grease and burnt powder. A dry cloth is run through the barrel to remove any remaining moisture. The gun is then ready to be oiled and greased.



Stopping Auto Noise Transmitted through Oil Pipe

Motor noises are often transmitted to the inside of an automobile body through the oil line which leads to the pressure gauge on the instrument board. The sound travels along the copper tube and is sometimes amplified by the steel board, which acts as a resonator. To stop this noise, cut the oil line, separate the ends about 1 in., and slip a piece of high-pressure air hose over the ends, clamping it on securely.

Wooden Rollers of Various Shapes Will Be Found Handy for Quickly Applying Glue to Boards

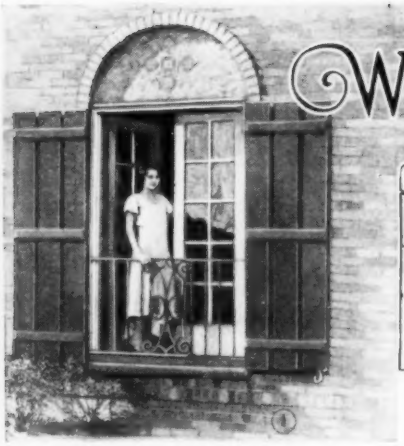
Roller Spreads Glue Quickly

For large gluing jobs, this roller-type spreader will be found a saver of time and also of glue. A large gluepot is fitted with a wooden roller driven on an iron rod, which rests in two notches cut in the top edge of the pot. In use, the stick is pressed over the roller as shown. Rollers for applying glue to the edges of tongue-and-grooved stock are shown in the detail.—Waldo Orton, Griswold, Iowa.

Razor-Blade Cutter for Slitting Album Leaves

For cutting parallel slits in album leaves to mount photos, this twin razor-blade cutter has been found extremely useful. Two small machine screws, about 1½ in. long, are slipped through one of the blades and through the flat portion of a wooden handle, which is also drilled to receive the screws. The second blade is then slipped on, and two nuts are used to hold the assembly together. In using the tool, an underlay of soft wood or smooth cardboard should be placed beneath the album leaf.

Window Shutters



OUT of the past comes the window shutter, making plain homes attractive and attractive homes more beautiful. The simplicity of their construction offers pleasant work to the home craftsman. Before making the shutters, carefully decide what kind will look best on your home. Some types are too ornate for a simple little bungalow, while other styles may be too plain for a larger dwelling. Also, the problems of grouped windows and windows close to corners, where the siding is insufficient to back the shutter, must first be solved. Then, too, there is the question of whether or not the shutters should be hinged. If your aim in building these shutters is purely decorative, hinges are unnecessary, but if you intend to open and close them for practical purposes, hinges should be used. After these elements have been considered you can commence on the shutter construction.

Perhaps the simplest of all is the familiar grid type shown in Fig. 1; here straight uprights are banded together with two or three beveled crosspieces. Sometimes the latter are omitted, and long bolts are substituted, as shown in Fig. 9, wooden spacers being used between the uprights. One end of each bolt is turned over to form an eye, offering an easy method of coupling to hinge pins as can be seen in the detail.

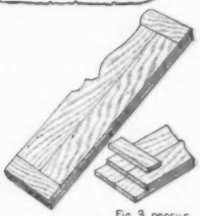
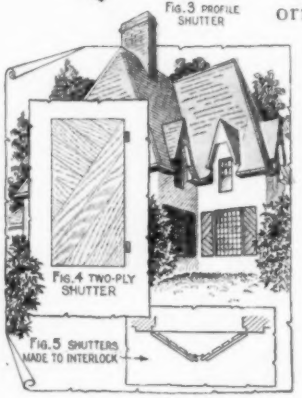


FIG.3 PROFILE SHUTTER



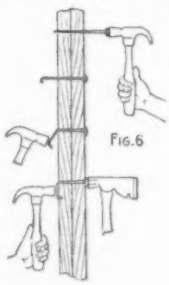
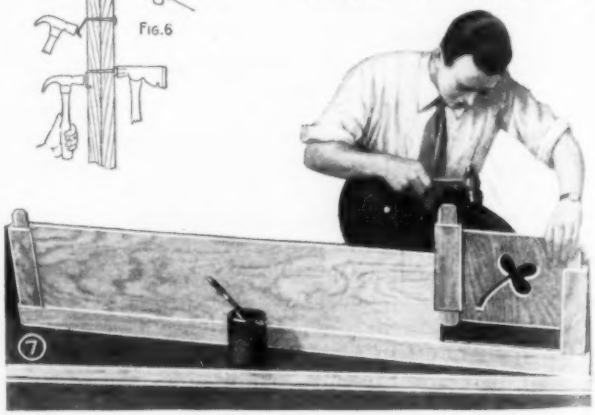


FIG.6

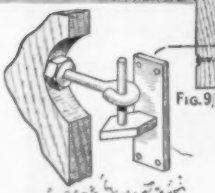
Closely allied to the grid blind is the batten shutter shown in Figs. 8, 14 and 15. In the first instance, two battens are butted close together and have diamond-shaped cut-outs in the center. The two boards are held together with cleats or with ornamental strap hinges. If the shutter is to be opened and closed, actual working hinges must be provided, but if the shutter is to be stationary, imitation hinges of wood or metal are fastened on with large-head upholsterers' tacks. The hinges should show when the shutters are open. The other side is cleated to hold the two boards together if the hinges are not strong enough for this purpose. The end of the hinge is fashioned to harmonize with the cut-outs.

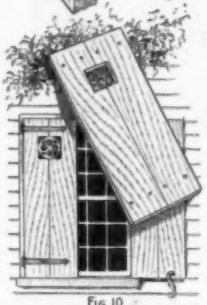
Another variation of the



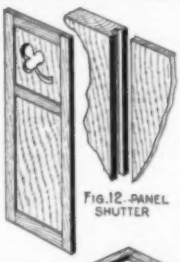
Improve Your Home

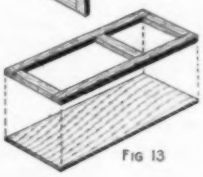
batten type of shutter has three or more boards, closely fitted together and with all edges beveled slightly to show a V-shaped groove between the joints. This type is cross-braced with two beveled cleats, and a diagonal strip is sometimes added as shown in Figs. 14 and 15. The true colonial method of fastening the cleats is shown in Fig. 5, round-head, square-shank nails being driven into place and clinched. While a true reproduction, this effect should not be used unless your home is of a colonial type.





Perhaps the most popular of the present-day window shutters is the paneled variety having suitable cut-out designs. An attractive cloverleaf panel design is shown in Fig. 12, the cut-out being made with a keyhole saw, Fig. 16. The outside framework is rabbeted all around to take the panels, and the crosspieces are tenoned into the uprights, after which the parts are assembled with finishing nails and glue, as shown in Fig. 7. These blinds should be hinged so that they may be opened and closed. If shutters of the panel type are your choice, and if the decorative note is your only aim, the above mortised and rabbeted construction need not be followed. A simpler panel style, offering the same effect from one side, is shown in Fig. 13. The cut-out, which is the main reason for the popularity of the panel type, may take on a score of different shapes, as shown in Figs. 2 and 11. The designs should be quite simple, as anything too ornate will weaken the wood.

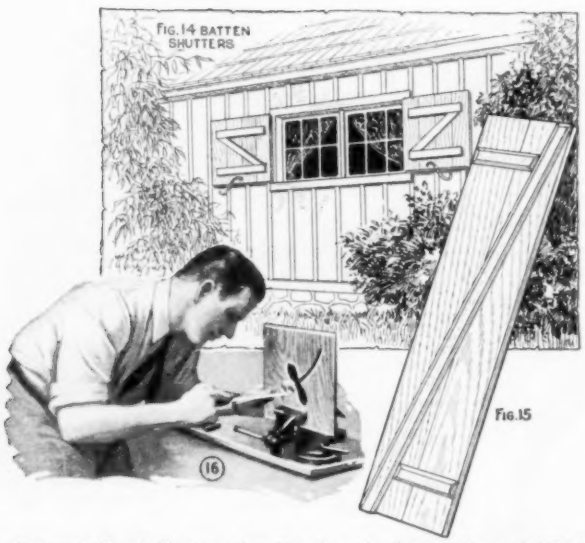




If desired, the cut-out can be run through part of each shutter, as shown in Fig. 3, to show as a whole figure only when the shutter is closed. This type, called the profile shutter, is fairly well known and can be used for either modernistic or period effects. Its construction is more or less varied, the more common method being to lap the endpieces onto the main uprights, as shown in the detail.

The Judas blind, an example of which is shown in Fig. 10, is similar to the batten type, except that the cut-out, usually square or diamond-shaped, is grilled with strap iron or flat brass to form an opening through which visitors may be scanned. The grill can be put in quite easily by merely lining the opening with channel iron or brass, and soldering the grill in place. Another method of attaching the grillwork is to drill holes through the metal and to drive round-head nails through the holes and into the wood. In this case, a pair of strap hinges, held in place with pyramid-headed rivets, may be provided on the outside to show only when the shutter is closed. Openings in Judas shutters may be fitted with cut-out silhouettes in copper or brass, the metal being held in place with light molding.

Two-ply shutters, as shown in Fig. 4, are also attractive and are fairly simple to construct. The diagonals are made of



Although Panel Shutters Are Popular, the Batten Type of Blind Is Also Highly Attractive

tongue-and-groove stock, or the whole blind may be made from two pieces, with saw cuts scored diagonally across the face of each, to resemble joining widths of narrow stock.

The old-fashioned louver, with its many slats facing inward and upward, retains its well-earned popularity, but as used today is invariably a semi-louver, the top portion being paneled and carrying a cut-out design.

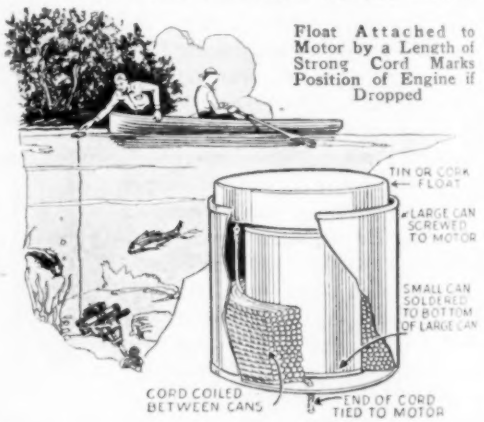
Naturally enough, the shape of the window largely determines the shape of the shutter. Usually a window looks best with a shutter on either side. On extremely narrow windows the shutters are often arranged to interlock, as in Fig. 5. Thus the shutter may be made a trifle wider than half of the window. Small windows are often shuttered with a single blind, especially if the window is balanced with another. Two small windows in a pair are usually shuttered with two blinds, one for each. Arched and odd-shaped windows present their own problems, usually calling for a particular shape of shutter to fit. The color scheme is also important. Nowadays, most houses are finished in one color, or in tints or shades of one color. Thus the value of contrasting shutters is at once apparent. Even though the windows are finished in the same general hue as the house, the shutters should contrast to create the most pleasing effect. If desired, the garage can also be trimmed with blinds to match those on the house.

Blueprint Paper Made at Home

Satisfactory blueprint paper can be made at home with the following solution: In one bottle, dissolve ammonium citrate of iron, 3¾ oz., in water, 18 oz., and then dissolve red prussiate of potash, 2⅝ oz., in the same quantity of water, in another bottle. Have the paper to be treated close at hand in a photographic dark room lighted only by a ruby light. Mix equal parts of the solutions and apply with a sponge. Put the liquid on in long parallel sweeps and on one side of the paper only. Hang the sheets up to dry and keep them in the dark until used. The mixtures spoil quickly, so it is advisable to throw away that which is not used.

Recovering a Lost Outboard Motor

Attached to the outboard motor, the illustrated float will often be the means


Float Attached to Motor by a Length of Strong Cord Marks Position of Engine if Dropped
TIN OR CORK FLOAT
LARGE CAN SCREWED TO MOTOR
SMALL CAN SOLDERED TO BOTTOM OF LARGE CAN
CORD COILED BETWEEN CANS
END OF CORD TIED TO MOTOR

of recovering it after it has been accidentally dropped in the water. It consists of two tin cans, one containing a coil of rope and a smaller one soldered to the bottom to keep the coil from entangling. One end of the rope is tied to the motor and the other to a float, which fits inside of the larger can as shown. The float should be buoyant enough to carry the rope to the surface.

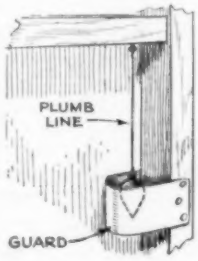
PICTURE-FRAME MOLDING CUT ON A POWER SAW

Small Power Saws Are Useful for Making Several Kinds of Picture-Frame Molding as Shown Above

There are three or four styles of picture-frame molding that can easily be made on a circular saw. Although all operations will be ripping, a fine-tooth cut-off saw is best to use for the purpose as there will be no trace of tooth marks on the finished work if it is run through slowly and carefully. A dado may be used, but it is not necessary. To make ½-in. molding, set the fence ½ in. from the saw, and run the saw table up so that it will cut through the stock, which should be ⅝ in. thick. Rip the stock up into ½-in. strips. Lower the table until the saw will make a cut ⅜ in. deep, and run the strips through again to make the bead on the ½-in. side as shown in Fig. 1, the fence having been adjusted so that the saw will take off just a slice equal to its width. Set the table for a ½-in. cut, move the fence ¼ in. from the saw, and run the strips through again, as shown in Fig. 2, after which a cut is made through the adjacent side, completing this particular type of molding. Variations from this style are shown in Figs. 4, 5 and 6. The half-round molding is run in the same manner except that there is no bead. Details A to F show the various operations. A sand block for rounding the molding is shown in the upper right corner of the illustration. First use a piece of coarse sandpaper and then finish with a fine grade. The bevel-face molding is cut in a similar way, except that the saw table should be tilted when the cutting of the face is done.

Permanent Plumb Bob Kept on Portable Machines

Leveling thrashing machines, tractors and other portable machines, which is often necessary, is simplified by applying the idea indicated in the illustration. A plumb bob is permanently suspended a few inches from a vertical part of the frame where it will not be caught by moving parts or lost in any way. A sheet-metal guard is bent to a semicircular shape and nailed or bolted to the frame around the bob, allowing sufficient space for it to swing. In case of a large machine, it is advisable to use one plumb bob at each end.



Radio Set Helps to Detect Loose Contact in Electric Cord

When the toaster won't toast or the percolator won't "perk" at the customary speed, owing to a loose connection, the source of the trouble can be located easily with the aid of your radio set. Turn on the set and then plug in the suspected electrical appliance. Push and pull gently on the cord both at the appliance and at the plug. If the radio "clicks" when you move the cord, the loose or defective part is at the point where you are handling it.

¶Slip a small rubber band over a spool of thread to prevent its becoming unwound.

A Paint Stand Consisting of a Wooden Disk, Floor Flange, Pipe Nipple and a Rod

Revolving Paint Stand Held in Vise

When lacquering small cabinet drawers and many other jobs, a revolving stand will be found handy. A 2 by 10-in. wooden disk forms the top, which is screwed to a floor flange attached to a short piece of pipe. This is slipped over a rod held in the bench vise, allowing the stand to turn while it is held in a vertical position.

This Stone Boat Is Easy to Dump

For hauling stone on the farm, the illustrated boat was found convenient. A cylindrical container made of 2-in. wood is mounted on skids, with a crossbar in front to hold a chain. By turning the horses at right angles to the load and hooking the chain over one of the cleats nailed to the front, the boat is easily turned on its side. A grab hook is attached to the chain to shorten the hitch for pulling.

Dumping the Load Is No Job at All with a Stone Boat of Cylindrical Shape

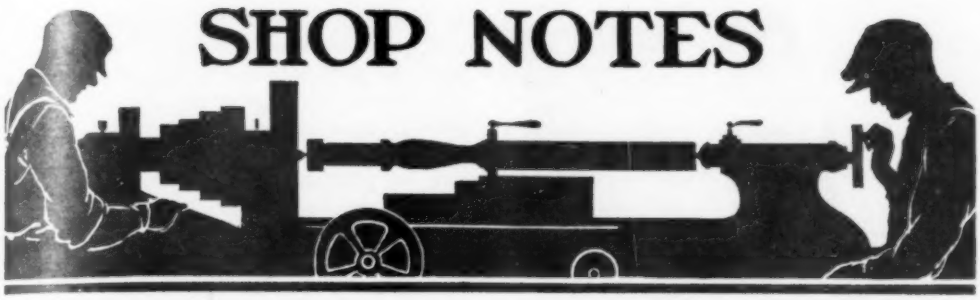
Correcting Sprung Auto-Door Hinge

Auto-door hinges are sometimes sprung out of position when backing into a garage with the door open. To bring them back to normal position, hold a block of wood in the hinge between the door and the frame. Then close the door sufficiently to force the hinge back into place.

Mounting Photos in Watch Covers

Nearly everyone who has ever attempted to place a photograph in the cover of a closed-face watch, has learned, usually at the expense of a broken crystal, that there is not sufficient clearance between the cover and the crystal for the thickness of the average photographic print. Such a print can be reduced in thickness by the following method: Cut out the picture to the desired diameter. Wash the hands thoroughly, and then lay the picture face down on a piece of clean blotting paper. After dipping the fingers in water, gently rub the back of the print. After a little rubbing the paper will begin to soften, and roll up. The rubbing should be carefully continued over the entire back of the print. To observe the amount of paper that is being removed, the picture should be held against a strong light. This will show up the thin places, and further removal of paper should then be confined to the thick spots. In a few minutes, the heaviest print can easily be worked down to such a thickness that it will go into the watch cover without touching the crystal.

¶Hardened paint and varnish can be removed from brushes with vinegar.



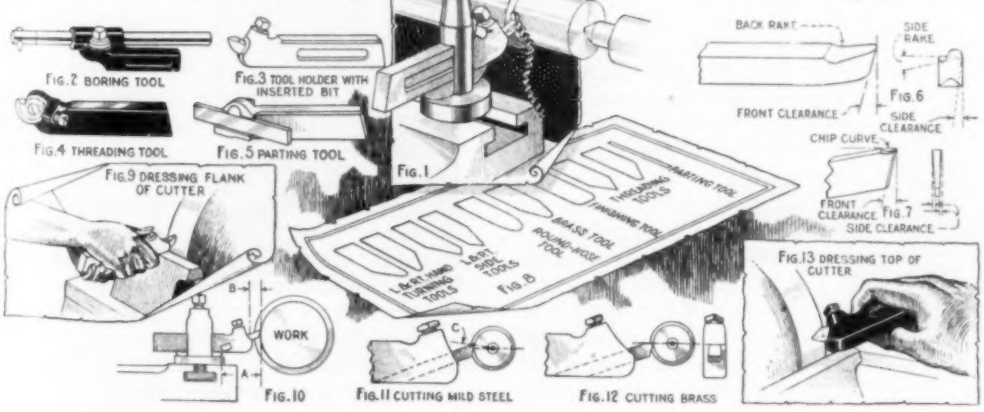
How to Grind Metal-Cutting Lathe Tools

By E. R. HAAN

ALMOST any lathe hand can grind an edge on his cutting tools, but to do it properly with the correct side and back rake and front clearance, which is essential to have the tool work most efficiently, is quite another matter. Then, too, tools must be ground differently for use on various kinds of metal. Properly ground, a cutting tool should turn off a nice curled chip of mild steel as shown in Fig. 1.

For cutting this kind of steel, the usual round-nose "roughing" tool or bit should be ground approximately to the shape shown in Fig. 6. When turning toward the left, the side rake should slope down on the right of the tool from 14 to 20°, while the back-rake angle should be about 8°. For hard steel, the side rake should be about 9° and the back rake 5°. These angles are subject to certain variations, depending on the position of the tool against the work, which, in turn, is largely determined by the kind of metal to be cut and diameter of the work. As a rule, the cutting edge should be located about $\frac{3}{64}$ in. above the center or base line of the work, for each inch of its diameter. Thus, work 4 in. in diameter requires the cutting edge to be raised $\frac{3}{16}$ in. above the center line, as indicated at C, Fig. 11. After this distance has been determined, the front or flank of the tool is ground down in order to obtain the necessary clearance. Obviously, a tool ground for work of small diameter, as indicated in Fig. 14, does not need so much front clearance as one applied to a large diameter. Consequently, the former cannot be used on large-diameter work without dressing down the flank, or you would get the effect shown in Fig. 15, detail A, where the work rides against the flank of the tool.

On the other hand, a tool having the correct front clearance for large work is not satisfactory for small work, as the front-clearance angle is then too great for the latter, and the chip pressure on the point would soon cause it to crumble, owing to lack of



Rake, Clearance and Keen Edge Largely Determine Efficiency of Cutting Tools

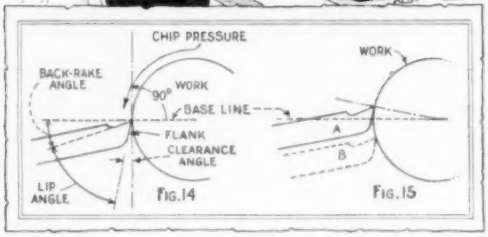


FIG. 14 FIG. 15

support underneath. Detail B of Fig. 15 shows this relation of the tool to the work. The angle between the lines of the front clearance and back rake should, however, correspond in such variations. This angle, known as the "lip angle," should be as large as possible in order to maintain the strength of the tool, and accordingly an angle of from 61 to 68° will be found most satisfactory.

For cutting cast iron, high carbon steel and annealed tool steel, the lip angle should be slightly greater than in the case of mild steel. Grinding the flank of the tool is done as shown in Fig. 9, while Fig. 13 illustrates the method of dressing the top. For turning brass, bronze and similar soft metals no side and back rake are ground on the tool, and the cutting edge of the latter is adjusted right on the center line, as shown in Fig. 12. Another thing to bear in mind when setting up the tool, is to keep the distances A and B, Fig. 10, as short as possible in order to give the tool the necessary rigidity to cut without chattering.

Various types of tools are needed for different operations, and a number of shapes, looking down on them from above, are shown in Fig. 8. When turning toward the left, the extreme left-hand tool is used, while the second is employed when turning toward the right. For turning on side faces, the second pair of tools is suitable. A brass tool has a sharper end than a round-nose tool for turning steel, to eliminate the tendency of digging into the work. For making a smooth finishing cut, a tool having a broad, flat end will be found best. Thread-cutting tools can be purchased in the form shown in Fig. 4 and require only grinding on the top, or a threading tool can be ground to shape for the particular thread desired. To turn the inside of cylinders, a boring tool, as shown in Fig. 2, is used, while a parting tool, Fig. 5, serves to cut off the work. The latter is set so that the cutting edge is exactly on the center line of the work. Sufficient front and side clearance are necessary, as indicated in Fig. 7, and a chip curve is grounded on the top, providing back rake. However, no side rake is given. To get an extremely keen edge on cutting tools, treat the edges as you would a razor blade. After grinding, hone them carefully and often so that they will be sharp at all times.

This Drum Mixer Stirs Poultry Feed Quickly

This grain mixer will handle more than a bushel at a time. It is of drum shape with wooden ends, and an 18-in. width of galvanized iron is tacked to the edges of the ends. The door is a piece of the galvanized iron, bent to conform to the curvature of the drum, and is held in place by two strips of the metal raised to allow the door to slide. The photo shows the mixer open and the door nearly pulled out. The whole arrangement is rigged between two 2 by 4-in. posts in the feed-storage room. The shaft and handle are made of ½-in. gas pipe and connected by a tee. The shaft is drilled for pins which lie against the ends and are stapled to the latter.

Getting More Service from Your Flashlight Battery

When your flashlight begins to get dim, it is not necessary to buy new batteries. Simply put in a lower-voltage lamp. For example, if you have a three-cell light with a 3.8-volt lamp, substitute a 2.5-volt lamp and continue to use the old batteries, which will provide enough current to give a bright light for a long time. The lamp substitution will not give as good service as a set of new batteries but it is more economical and will often serve the purpose satisfactorily. However, do not forget to replace the original lamp when new batteries are installed, as the lower-voltage lamp would burn out in a short time.

This Wrench Has Quick Adjustment

Almost any steel monkey wrench can be made quickly adjustable by removing the thumbscrew and adding a pawl. Drill a hole in the movable jaw near the outside, as shown in the drawing, and file through to form a slot, the width of which should be less than the diameter of the hole. The pawl is ground to a dull edge at one end, to catch in the teeth. These should be filed at an angle on one side and straight on the other side so that the pawl will ride over them when the movable jaw is closed. The straight side prevents the pawl from slipping back when pressure is applied on the tool. The top end of the pawl is rounded off to fit into the slot in the movable jaw, as indicated. If desired, a hole may be drilled and tapped in the sides of the movable jaw adjacent to the hole that holds the pawl, so that the heads of short screws keep the pawl from slipping out.

To set cutting tools in a moving machine is exceedingly dangerous.

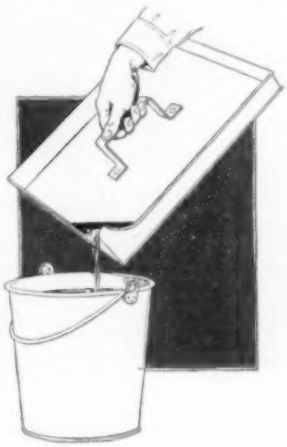
With This 12-ft. Level Jack Mounted on Casters, One Man Can Raise an Airplane

A One-Man Jack for Lifting Airplanes

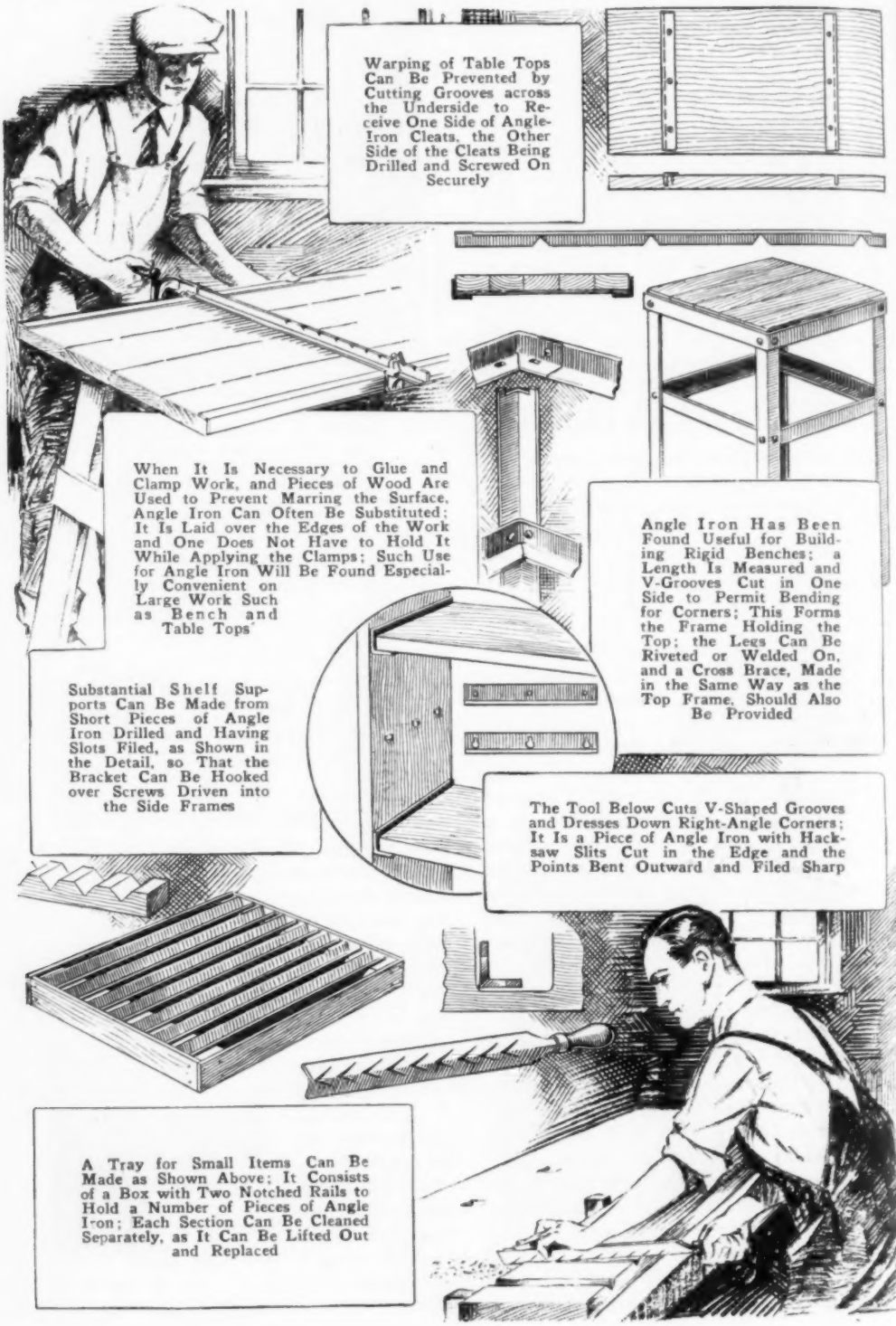
In order to raise airplanes when it is necessary to change tires or wheels on the landing gear, or when making other repairs, engineers at Crissey field near San Francisco, fashioned a lever jack mounted on casters for easy moving. The lever is 12 ft. long, and one man can lift a plane with little effort, although two men generally operate the lever.—Kirk L. Truman, San Francisco, Calif.

A Spout and Handle for Drip Pans

Drip pans in machine shops will be much more easily emptied, if provided with a spout at one end as shown. This may be done by extending one corner when making the pan, or by adding a spout to those already in use. A handle, riveted to the bottom in the center, makes the pan easier to pick up, and one may be carried in each hand, if desired.



A FEW PRACTICAL USES FOR ANGLE IRON IN SHOPS



Warping of Table Tops Can Be Prevented by Cutting Grooves across the Underside to Receive One Side of Angle-Iron Cleats, the Other Side of the Cleats Being Drilled and Screwed On Securely

When It Is Necessary to Glue and Clamp Work, and Pieces of Wood Are Used to Prevent Marring the Surface, Angle Iron Can Often Be Substituted; It Is Laid over the Edges of the Work and One Does Not Have to Hold It While Applying the Clamps; Such Use for Angle Iron Will Be Found Especially Convenient on Large Work Such as Bench and Table Tops

Angle Iron Has Been Found Useful for Building Rigid Benches; a Length Is Measured and V-Grooves Cut in One Side to Permit Bending for Corners; This Forms the Frame Holding the Top; the Legs Can Be Riveted or Welded On, and a Cross Brace, Made in the Same Way as the Top Frame, Should Also Be Provided

Substantial Shelf Supports Can Be Made from Short Pieces of Angle Iron Drilled and Having Slots Filed, as Shown in the Detail, so That the Bracket Can Be Hooked over Screws Driven into the Side Frames

The Tool Below Cuts V-Shaped Grooves and Dresses Down Right-Angle Corners; It Is a Piece of Angle Iron with Hacksaw Slits Cut in the Edge and the Points Bent Outward and Filed Sharp

A Tray for Small Items Can Be Made as Shown Above; It Consists of a Box with Two Notched Rails to Hold a Number of Pieces of Angle Iron; Each Section Can Be Cleaned Separately, as It Can Be Lifted Out and Replaced

Releasing a Stuck Auto Starter

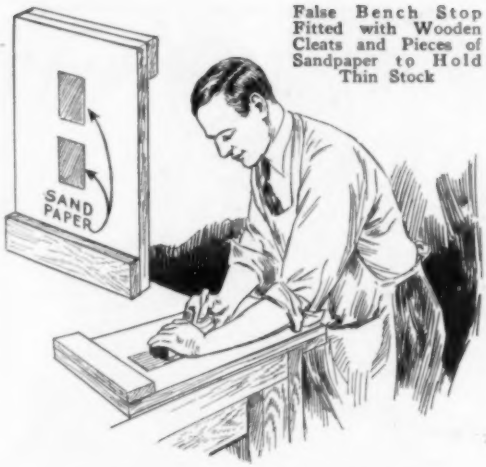
Most automobiles have starting motors fitted with a Bendix drive. If the motor does not fire on the first contact, the pinion may remain stuck in the flywheel gear. Repeated contacts of the starter switch will only make matters worse by jamming the pinion tighter. To remove the parts, so that access may be had to the offending pinion, is no small task. A quick method of releasing it, and one which has proved successful in nearly all cases, is to place the gearshift in reverse, then have another motorist give the disabled car a sudden push. This will cause the flywheel gear to revolve the pinion on its threaded axle and put it out of mesh. One should make sure, however, that the starter switch is open during this operation. Unless the teeth of the pinion or flywheel are badly battered, this procedure will save many a dirty job or the time and cost of hiring a mechanic.—J. M. Kline, Kansas City, Mo.

Battery Clips Hold Warning Flag

Spring battery clips, often used in radio installations, make excellent holders for red warning flags. A hole is drilled in the end of the clip so that it can be attached to the hem of the flag by means of a screw and nut. Suitable washers are

Spring-Type Battery Clips Make Quickly Attachable Holders for Red Warning Flags

provided under both the screw head and the nut to avoid tearing the cloth. In use, it is a simple matter to attach the clip almost anywhere.



False Bench Stop Fitted with Wooden Cleats and Pieces of Sandpaper to Hold Thin Stock

How to Plane Thin Wood

For planing thin wood without injuring it, when the ordinary bench stops are unsatisfactory for the purpose, a false bench stop with a cleat at each end on opposite sides, and some sandpaper glued to one side as shown, will be found convenient. The sandpaper holds thin work that is not as wide as the cleats. The cleats, of course, should be a trifle narrower than the material generally used. For very thin stock, a small hole can be drilled to receive match sticks, which serve as stops.

Rubber Bands Support Ironing Cord

To keep an electric cord out of the way while ironing, an effective support may be made of rubber bands. Link several of them together to form a chain, slip the cord through the band at one end and tack the other end to the wall or molding, about 3 ft. above the ironing board. The support not only keeps the cord out of the way, but also prevents excessive wear.

Thimble Forms Miniature Ladle

For handling small quantities of liquids, wax and similar materials, a serviceable dipper can be made from a large-size thimble. Wrap No. 18-gauge wire around the top rim and leave the end extend to serve as a handle. This makes a handy dipper or ladle for melting lead or wax.

¶Oxalic acid dissolved in water is excellent for cleaning tarnished brass.

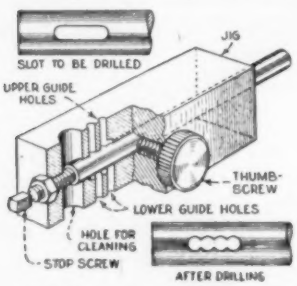
Tracing Work Can Be Simplified and Eyestrain Lessened By Installing a Lamp in Your Drawer

Electric Light in Desk Drawer Aids in Tracing

Those who frequently make small tracings at a desk will find the illustrated idea a great help in their work. An electric light is installed in the top desk drawer, using a porcelain socket which is screwed to the front of the drawer. Narrow wooden cleats are nailed along the edges of the drawer, near the top, so that a piece of glass can be held flush with the drawer top. A snap switch can be mounted near at hand, and the extension cord permanently plugged in the wall.—J. N. Stoody, Kenosha, Wis.

Simple Jig for Slotting Rods

The best method of slotting small rods when the cutting cannot be done on a milling machine, is to drill a row of overlapping holes and then even it out with a small file or broach. A simple and effective jig that facilitates this job, consists of a piece of tool steel, drilled out as shown and hardened. The first guide hole is drilled in the upper portion of the jig body; the second, in the lower portion; the third, in the upper, and so on. A cleaning hole is provided in order to allow chips to escape. If the binding screw is made of brass or bronze, it will not mar the work.

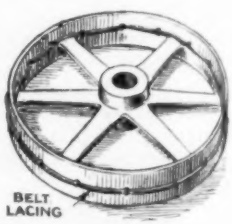


Test for Impurities in Concrete Sand

Clean sand is important in good concrete work. A simple test that reveals impurities is the following: Pour ½ pt. of the sand into a fruit jar containing a ½ pt. of water in which a heaping tablespoonful of lye has been dissolved. After putting the rubber and cap on the jar, shake the mixture thoroughly for a minute or two. Then set the jar aside and let the sand settle. In about 24 hours examine the water standing on the sand. If it is no darker than apple cider, the sand is suitable for concrete. If the water is of coffee color or darker, the sand is unsuitable and should be washed until the color is improved as indicated by repeating the test.

Improvised Crown on a Flat Pulley

Holes drilled between the spokes and in the center of the face of a pulley and belt lacing threaded through the holes on alternate sides of the rim, as shown in the drawing, form a false crown to keep the belt from slipping off. This improvised crown was found entirely practical.



Old Wringer Deflates Inner Tubes

A handy time and labor saver for the garage or tire-repair shop, is an inner-tube deflater made from an old clothes wringer. Lighter and weaker springs are substituted for those with which the wringer is equipped. To deflate a tube, pick it up by the valve stem allowing the tube to hang. Then grasp the tube at the bottom and, after folding it carefully, insert this part between the rollers. By turning the crank while the valve core is held open, the tube is run through as far as the valve and is then entirely free of air.

A Drum Sander *for the* Workshop

HERE is a homemade drum sander that gives excellent service and can be made for less than $50.

One-half-horsepower induction-repulsion motors are permitted on most lighting circuits, and for intermittent use, may be connected direct to the supply line without special power wiring. Such a motor will drive a 12 by 8-in. drum with ample power for all but the heaviest work. It should be fitted with either grease-lubricated ball bearings or end shields that are separate from the base so that it may be mounted in the position shown. In purchasing it, be sure to give the characteristics of the supply line.

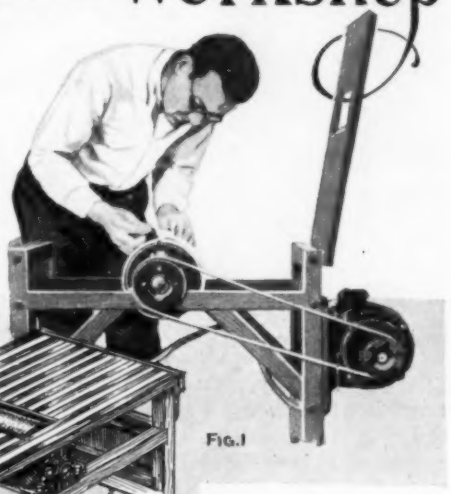


FIG. 1

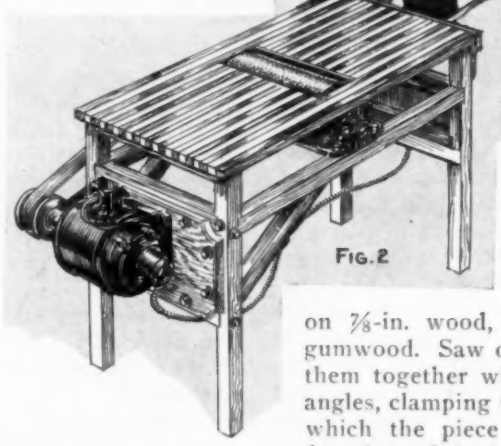


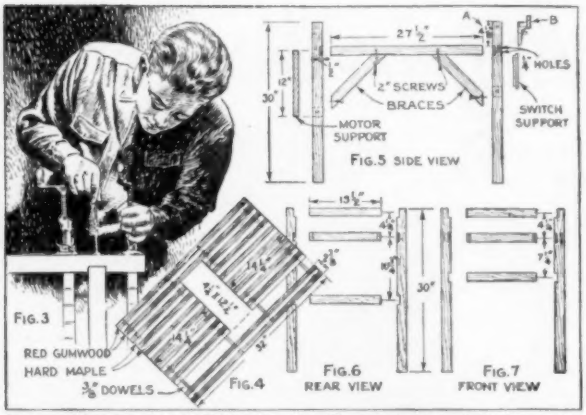
FIG. 2

A drum weighing about 35 lb. was taken from a discarded floor-surfacing machine and is shown in Fig. 9. Besides serving as a flywheel, the drum has a paper lock operating with a wrench. Such drums can usually be obtained secondhand or new from manufacturers of floor-sanding machines. The shaft is generally 1 in. in diameter and one end projects to carry the drive sprocket when used on the floor sander. As a rule this is long enough to admit a babbitted bearing and pulley. A ½-in. fiber washer is used on the shaft between the bearing and drum on the end opposite the pulley, so that the paper lock will not strike the bearing or frame, and a thin fiber washer is used on the opposite end between the bearing and the drum to make it run quietly. Two babbitted bearings, Fig. 10, to fit the drum shaft are needed. Also get a flange collar, machined and fitted with a setscrew. The flange should be 3 or 3½ in. in diameter and the hole should fit the shaft of the drum.

The pulley is made next. Set your compass to a 2¾-in. radius and mark off three disks on ⅞-in. wood, preferably maple or gumwood. Saw out the disks and glue them together with the grain at right angles, clamping tightly until dry, after which the piece is mounted on the faceplate of the lathe and turned down to correct size and shape, as shown in Fig. 8. A recess is provided to receive the flange collar. The flange rim should be a light driving fit in the recess to prevent the pulley from running out of true when placed on the shaft. Sink the recess ¾ in. deep and do not undercut the shoulder. Use a square-nose chisel and test the diameter carefully with inside calipers just before reaching the full depth, to insure a perfect fit of the flange. After the first recess has been finished run back a second recess slightly larger than the diameter of the drum shaft, as indicated at A in Fig. 8. Drill four ¼-in. holes through the flange rim, slip it into the recess and mark the location of holes for ¼ by 2½-in. machine bolts.

For satisfactory operation the frame of the machine must have maximum rigidity and strength without excessive weight. Use 2 by 2-in. oak.

Figs. 1 and 2 give two views of the



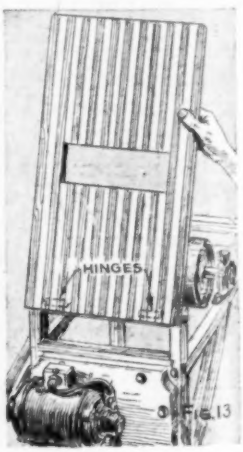
Frame Members and Table for the Drum Sander, Including All Necessary Dimensions, Except A in Fig. 5, Which Varies

completed sander. The various parts of the frame and their sizes are given in Figs. 5, 6 and 7, and the table top is shown in Figs 4 and 13. The dimension A, Fig. 5, which in this case was 4⅛ in., is very important. To get this accurately, set the drum, with bearings in place, on two blocks. Lay a board on the drum, letting the end project beyond the bearing, and having it parallel to the bottom of the bearing. In this position, measure the distance from the bottom of the bearing to the underside of the board. Deduct 1 in. from this measurement, which is slightly in excess of the thickness of the table. Be sure to allow for the clearance of the drum above the table, or it will be necessary to block up the drum, which is not always satisfactory.

Cut four legs and other frame pieces, and assemble as indicated in the drawing. Lay out mortises for the center crosspieces first. Remember that the dimension corresponding to the 4⅛ in. given here, determines the distance below the end of the post for the upper shoulder of the mortise. The mortises are laid out across two adjoining faces of the post, one to take the short crosspiece and the other to join the end of the lengthwise piece supporting the drum. The joints must fit tightly. Mark the waste of each mortise so that no mistake is made in cutting. The parts are held together with ¼ by 3-in. lagscrews, using a washer under the head of each. The holes for the screws are marked with the joining parts clamped together as shown in Fig. 3.

For the motor support, cut a piece of oak or gumwood 1 by 12 by 15½ in. in size. Cut out the upper corners so that the head of the lagscrews will not interfere with the piece coming solidly against the frame. Attach it with lagscrews and glue. The support for the switch at the front is cut ½ in. larger each way than the opening, and the edges are rabbeted to fit. It is held with glue and small screws, and adds to the rigidity of the frame. Fig. 4 shows the construction of the table, built up of laminated strips and joined with lengths of ⅜-in. dowel rod. This design, while more complicated than the usual type, is well worth the extra work, as it results in a table free from warping and of great strength. The light-colored strips are ripped 1 in. wide from ⅞-in. maple and alternated with similar strips of red gumwood. The top is built up in four sections, the end sections measuring 12¼ by 15 in., and the side sections, 2⅜ by 32 in. After each section has been assembled and glued separately, all are doweled together, and then the surface of the table is carefully sanded and shellacked.

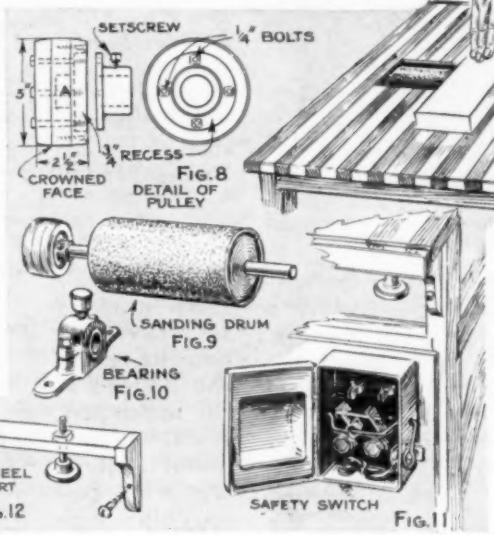
Mount the drum on its bearings and place the table carefully in position. Hold it with hand clamps and screw on a pair of butt hinges at the rear, as indicated in Fig. 13. Get two short coil springs and hook the ends over screwhooks in the frame and bottom of the table, to hold it down firmly and enable fine adjustment with the handwheels. The construction of the handwheels is shown in Fig. 12, and their position on the table is indicated in Fig. 5. Piece B is screwed onto the handscrew holder to protect the table edge from being racked sideways by a blow or pressure. Tack small

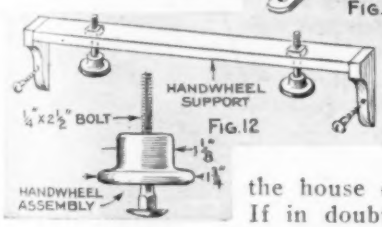


squares of tin to the underside of the table over the ends of the bolts. Bolt the motor in place, making sure that the drive pulley lines up with the one on the drum, and that the motor is square on the frame.

Complete directions for wiring to the 110-volt circuit are furnished with every new induction motor. Follow the wiring chart closely, soldering the connections where the four lead wires from the motor are connected to the line. These two connections must be very carefully insulated from each other with electricians' rubber tape and then with several turns of friction tape, after which the wrapping should be shellacked. Flexible metal conduit should be used to run from the motor to the switch of the line shown in Fig. 11, known as the "square-D type." A detachable plug is used to connect to the house-wiring circuit. The switch should never be fused higher than 15 amp. for use on the house current. If in doubt about the wiring, consult the power company or a competent electrician. Use a 2½ by 2½-in. fiber pulley on the motor, and a belt 1½ in. wide. This size pulley will give the drum a speed of approximately 900 r.p.m. when the load speed of the motor is 1,750 r.p.m. Do not tighten the belt too much, as this will greatly increase the starting load. It is better to use a light tension and occasionally apply belt dressing to prevent slipping. The best paper for a drum of this size is the fine-grit paper for floor-sanding machines.

This drum sander has capacity for speedy sanding and will turn out the finest finish when proper judgment is used in handling it, as is necessary with all sanders. Adjust the table so that the paper just touches the surface of the work, use only sufficient pressure to keep the work firmly on the table and, above all, keep it moving while in contact with the paper. Given a careful adjustment of the table and a minimum of pressure, the high speed of the drum will leave the surface of the work as smooth and clean as one could wish. To get the surface of the work perfectly square, both handwheels raising the table should be turned exactly the same distance, which is easy, owing to the rigidity of the table.





How Wood Can Be Waterproofed

A good waterproofing solution for wood consists of 4 oz. of asphalt, 30 oz. of pure rubber and 10 oz. of mineral naphtha. It should be applied with a stiff brush in three separate coats, letting each one dry before applying the next. Care should be taken in handling this solution, as its vapor is highly inflammable.

¶A piece of good plate glass will make a satisfactory emergency surface plate.

Extension Rod on Stepladder Adds to Worker's Safety

Danger of Falling from Stepladders Can Be Reduced by Providing This Extension Handhold

An extension rod provided on the left-hand side of a stepladder, especially a high one, is an excellent safety measure. When one has to stand on the upper step without support, such a rod will be found welcome. A couple of large screweyes are driven into one ladder sidepiece so that the rod can be slipped through both, while a small wooden block is screwed below to serve as a stop. The edge of the top step is notched to accommodate the rod. Any kind of strong metal or wood rod will serve the purpose.

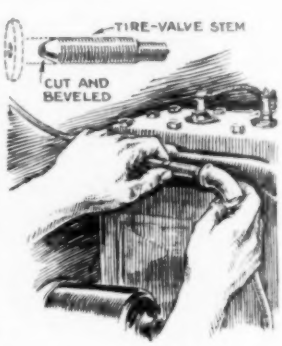
Shaft Size Increased by Peening

When the inner race of a ball or roller bearing wears the shaft and the fit becomes loose, the shaft may be peened with a center punch so that the bearing can be driven tightly in place. The use of the center punch in this manner raises small portions of the surface and the more of these raised places there are on the shaft, the better and more permanent will be the job. Wear of the outer race of a bearing in its housing may be repaired in a similar way.—A. H. Vance, Bensenville, Ill.

A Rat-Proof Brooder House

In order to keep rats from getting under the chicken brooder house, an effective barrier can be made from heavy woven-wire cloth. A trench, about 20 in. deep, is dug entirely around the house close to the edges. The wire cloth is then stapled, every 6 or 8 in., to the bottom of the brooder house and entirely around it, so that the lower edge of the cloth hangs down in the trench. Dirt is then thrown into the trench, and the result is a barrier that no rat can penetrate.—J. R. Koontz, Bremen, Ind.

Tire-Valve Stem Used to Blow Out Gas Feed Pipe



By cutting off a valve stem and beveling the cut end of the upper part, it will be found useful for blowing out gas-feed pipes with compressed air available at any garage or service station. The beveled end is held in the tubing and the other inserted in the air-hose nozzle. Air blown through the pipe dislodges any obstruction and cleans the pipe out thoroughly.

How to Save a Watch Dropped in Water

When a watch has been dropped in water, open the cover as soon as possible and immerse the watch in alcohol. Any kind of alcohol can be used for the purpose except wood alcohol. After removing the watch, shake out as much of the liquid

as possible, and drop it into a cupful of kerosene, keeping it there until it can be taken to a jeweler for cleaning and repairs. If the watch has been immersed in salt water, it will be ruined within a few hours if not quickly and properly treated, although it will suffer little damage until it has been exposed to the combined chemical action of salt water and air. If running water is available, open the cover and let the fresh water run through the works for several minutes to remove all traces of the salt water, and then follow the procedure already described.

Increasing Utility of Ladle

The illustrated ladle has been provided with several added conveniences which greatly increase its utility. An inside spout, opening at the bottom, is a most valuable feature as it prevents pouring scum which floats on the surface of babbitt. An iron rod bent to a V-shape and welded onto the underside of the handle makes a good rest, permitting a flat-bottomed ladle to be set down without any risk of spilling. A hook welded to the front edge of the cup will be found useful for lifting a crucible pot off the fire, while a similar hook on the top of the handle near the cup permits one to attach an extra handle when the load is heavy.

An Extra Rest, Spout and Two Hooks Make This Pouring Ladle Exceptionally Handy

Electric Fan Placed behind Large Gas Burner Provides Warm Air for Drying Negatives on This Overhead Rack

Hot Air Dries Films on This Overhead Rack

Films and plates can be dried in a very short time on an adjustable, overhead rack that holds 3 or 4 doz. hangers at a time. It is raised and lowered by means of a sash cord run over pulleys, the same method of attachment being used at each end. The rack itself consists of 1-in. hardwood, 3 in. wide and 8 ft. long, having ½ by 2-in. crosspieces spaced 1 ft. apart and notched to hold the hangers. A blast of warm air is directed against the negatives by an electric fan placed behind a gas burner of the kind used under large coffee percolators. By raising the rack to the ceiling the plates are entirely out of the way and also in a better position for drying as the air near the top of the room is generally warmer than that near the floor. —Fred H. English, Springfield, Mo.

Soap Used to Stick Paper to Glass

A bar of yellow laundry soap makes an excellent substitute for paste or mucilage in attaching posters to glass, store windows and soda-fountain mirrors, for instance. Simply press the corner of the cake to the poster hard enough to leave a little soap adhering to the paper.

Hacksaw Blade Makes Accurate Section Liner

Attached to the T-Square, a Hacksaw Blade Makes a Neat and Accurate Section Liner for Draftsmen

Here is a simple section liner that costs only 10 cents. Get a hacksaw blade and attach it to the top side of the T-square, with the teeth up as indicated. A piece of sheet metal, cut to triangular shape, is attached to the lower edge of a triangle so that the point of the sheet-metal piece engages with the teeth of the hacksaw blade. As the teeth are equidistant, the spacing of the lines will be the same.

Testing Canvas for Quality

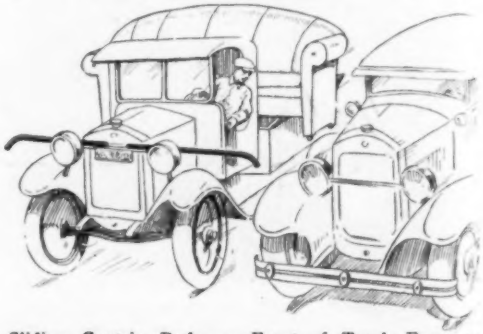
When purchasing canvas or cotton duck, there are several simple tests for determining its quality. Hold the canvas up to the light and, if you can see many pinholes or places where the material is thin, it is a poor grade and will not wear well. Canvas known as U. S. standard army duck does not show many pinholes or thin places when exposed to the light. It is made of multiple-ply yarns and is not bleached, loaded or sized. You can ascertain the ply of the yarns by untwisting and counting the number of small threads into which they separate. To determine the closeness of the weave, unravel the material and count the ends of yarn per inch. If you buy khaki-colored canvas, and wish to know whether it has been dyed with mineral or organic dyes, the following test is a positive means of identification: Burn a small piece until no carbon remains in the ash. If the dye contains mineral matter, a considerable quantity of ash, colored from buff to dark brown, will remain, but if an organic dye has been used, only a little white to gray ash will be left.

Ammonia as a Fire Extinguisher

Ammonia pistols have been found quite effective, under certain conditions, for extinguishing small gasoline fires. As the fumes are heavier than air they quickly smother the flame, especially if it is confined. A bottle of ammonia, carried on the car, therefore makes a good fire extinguisher on tours and is also useful for cleaning glass and metal. An automatic fire extinguisher for the garage may be made by suspending bottles of ammonia from the ceiling by means of inflammable strings; which, upon burning, allow the bottles to drop and break. The ammonia fumes in the confined garage would be of considerable assistance in checking if not entirely extinguishing the blaze.

Adjustable-Width Gauge on Truck Protects the Load

Truck drivers who frequently handle loads that project beyond the sides of the truck, will find an adjustable crosspiece on the front helpful in gauging clearance. Such a gauge can be made from a pair of sliding curtain rods, arranged in front of the radiator and attached securely to the lamp brackets or fenders. Before starting with a load, the driver sets the rods to represent the width of the load so that he has a constant reminder of it before him and can readily see if he has enough space in alleys and other restricted places.

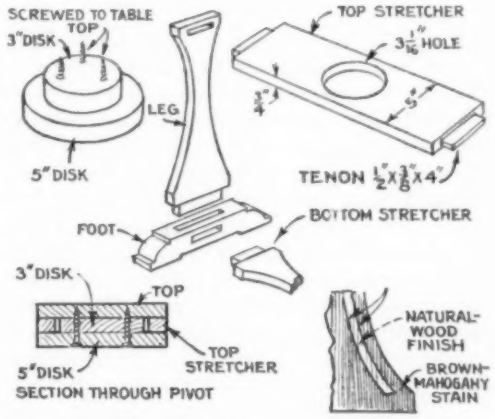


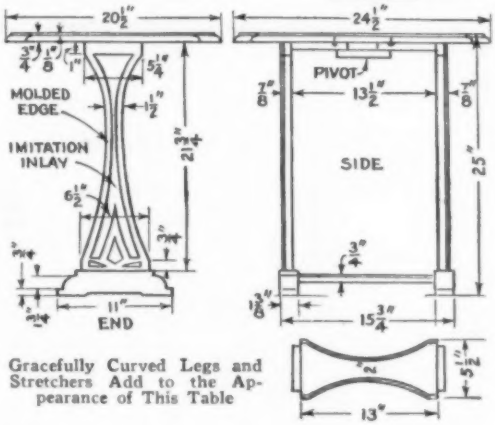
Sliding Curtain Rods on Front of Truck Form an Adjustable-Width Gauge to Protect the Load

A Drop-Leaf Pivot-Top Table

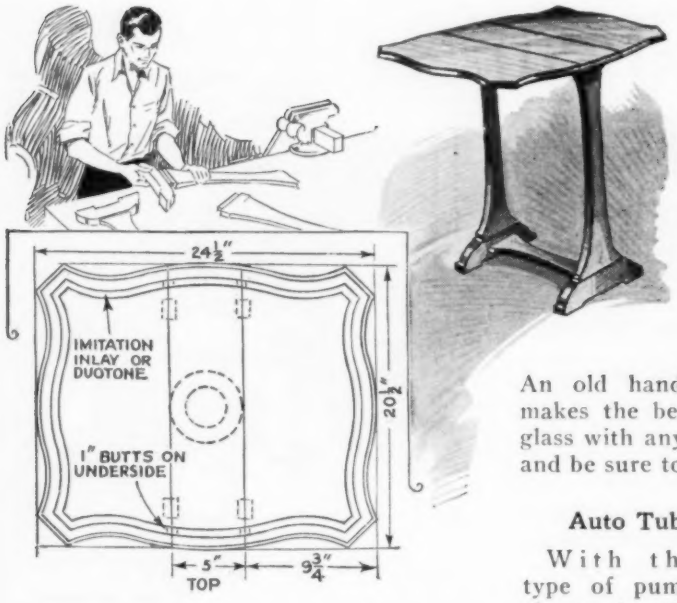
HERE is an exceptionally attractive drop-leaf table with pivoted top that can be duplicated easily by anyone. Ordinary tools found in the home workshop will suffice. The equipment of most public manual training schools is available to night as well as day classes, and offers an opportunity to turn out this job in first-class manner. Using genuine mahogany, the average cost of this table will be about $4.

The top consists of three pieces of ¾-in. material. For the center or pivot piece, 5-in. wide material is used, and the leaves are cut from 10-in. widths. Saw the leaves to the shape indicated in the drawing and fasten to the centerpiece with temporary battens on the underside; then fashion the edges with a molding cutter. For the legs, use ⅞-in. mahogany sawed to graceful curves as shown, the narrowest portion being about one-third the distance from the top end. There is a mortise at the top of each leg to receive a stretcher, and mortise-and-tenon joints also hold the assembly together at the bottom, as indicated. These mortises should be ⅜ in. wide and ½ in. deep. The bottom stretcher and leg should have molded edges. In the center of the top stretcher, a hole is sawed about 3 1/16 in. in diameter, or slightly larger than a 3-in. wood disk that is to turn in it. Before assembling the parts, mark the outlines of the duotone or imitation-inlay designs. This can be done satisfactorily with a marking gauge, and the outlines then darkened with a soft lead pencil, which also prevents the dark stain from running over into the lighter portion. Sandpaper all pieces to a smooth finish and assemble the main frame, gluing the joints and clamping together until dry. For the pivot, cut two circular disks of ¾-in. hardwood, which are to be screwed to the underside of the top centerpiece, when





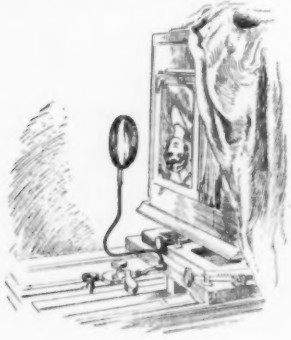
Gracefully Curved Legs and Stretchers Add to the Appearance of This Table



the staining and finishing have been completed. In working out the duotone effect, the lighter portions are given a thin coat of white shellac, and when dry, brown mahogany water stain is applied to the other portions, as well as filler. Finish all surfaces with a fine grade of sandpaper when dry, and apply two more thin coats of shellac. Complete the final assembly of the top, hinging the leaves to the centerpiece with 1-in. butts on the underside, about 1½ in. from the edge. Insert the pivot disk in the hole in the top stretcher and screw to the centerpiece.

With carefully applied finish, this table makes a really handsome piece of furniture and will be found handy for many purposes.

Reading Glass Helps in Focusing



Photographers will find the installation of a large reading glass on the sliding bed of the camera, an aid in getting a sharp focus. It covers a large field and is always in position when needed, even when using the sliding back to take two pictures on one plate.

Cambric for Cleaning Glass Lenses

Clean cambric, a fine thin white linen fabric, has been found especially suitable for cleaning the lenses of cameras, spectacles and other articles. An old handkerchief of that material makes the best cleaner. Never rub the glass with anything likely to contain grit and be sure to rub lightly.

Auto Tube Used to Prime Pump

With the type of pump shown in the drawing priming can be accomplished with the aid of a piece of inner tube, one end being slipped over the spout and held tight, after which water is poured into the tube. Where a tubful of water is handy, the water can be scooped up in the tube with one end squeezed shut.

Photo Background Tinted with Ink Can Be Folded

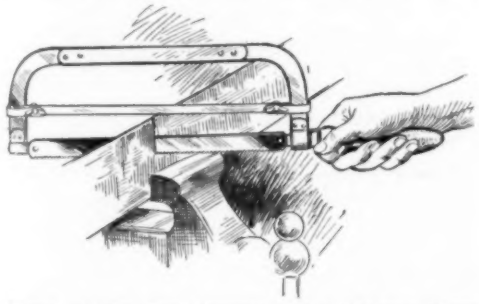
For several years I have used painted background curtains in making home-portrait photographs, and as the curtains had to be folded and unfolded, the paint at the folds cracked. In making up a new background, I found it much better to ink the cloth instead of painting it. This was done with the aid of a fly sprayer filled with ink of desired shade, spraying until the proper tint had been obtained. The spray was then emptied and washed with gasoline, after which ink of another color was put into it and the other side sprayed. —Duke D'Ambra, Lawrence, Kans.

Keeping Leather and Rubber Belts in Good Condition

Usually the only care the average belt gets is to have new lacings put in when the old ones wear out and a piece cut off when the belt is tightened. A little attention will increase its life and usefulness considerably. Belts should be run as slack as possible, being just tight enough to do their work. More belts are ruined by being unnecessarily tight than are worn out in actual service. If a leather belt gets dirty from an accumulation of dust and oil, take the time and trouble to clean it. The grease and dirt can be loosened with a mixture made of 3 parts of benzine, naphtha or gasoline and 1 part of turpentine. If such a mixture is prohibited in the shop because of fire hazard, use the turpentine alone. After the belt is clean and dry, apply a light coat of some good belt dressing or, in the absence of that, a little castor oil or tallow. The mixture mentioned is intended for cleaning leather belts only, and should not be used on rubber belts. These may be cleaned with a little soft soap and water. To make them more pliable and cause them to stick to the pulleys, moisten lightly on the inside with boiled linseed oil but no other kind.

Hacksaw Stop Limits Depth of Cut

For cutting with a hacksaw to a certain depth, a stop attached to the saw frame, as shown, will be found useful. It consists of a length of strap iron with the



Length of Flat Steel Clamped to the Hacksaw Frame Limits Depth of Cut

ends bent to fit over the frame. Screws and wingnuts are used to clamp the bent ends onto the frame at the proper points to stop the cut at the desired depth.

Here Is a Cheap and Easy Method of Making Stereotypes with Molten Type Metal

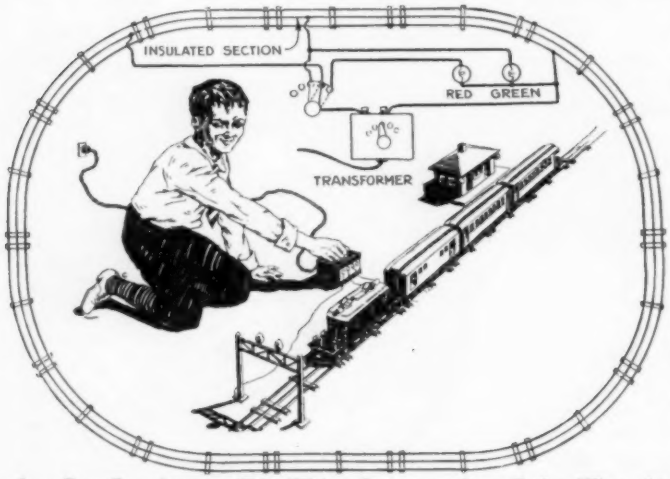
Type Metal Used for Making Newspaper Cuts

For making cuts a small mid-western printer has found the following method successful: A steel plate or galley form is boxed to hold a 1/16-in. layer of thin paste made from chalk and water. After the water has evaporated and the chalk is thoroughly dry, the drawing is penciled on, after which it is cut through the chalk to the steel with a stylus made by grinding down the sides of a steel knitting needle. The stylus is held vertically and the lines are cut with a scratching or rubbing motion. Do not attempt to cut through the chalk in one stroke as this may chip it. After the etching has been completed and the dust blown off, type metal is poured on to a thickness of 1/8 in.

Renovate Oilcloth and Linoleum with Paraffin

Dissolve 3/4 lb. of melted paraffin in 1 qt. of turpentine, warmed in a pan set in hot water, and, while still warm, apply the mixture with a sponge or cloth to the oilcloth or linoleum. It can also be used on painted floors. After 24 hours, the floor should be polished, which will bring out the gloss.—Arthur T. Bowden, Ottawa, Kans.

WIRING TRACK TO STOP TOY TRAIN FOR RED LIGHT

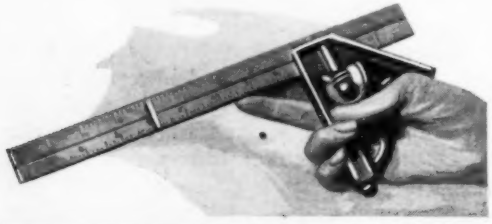


Any Boy Can Arrange This Wiring System to Stop Trains When the Semaphore Shows a Red Light

Here is a simple wiring circuit that can be applied to any toy train so that it stops automatically when the red light is turned on, but keeps on going with a green light. Get 3 flat-head switch-contact points and a switch lever from the radio store and mount them on a piece of bakelite, so that the lever touches two contacts at once. The contact at the left is connected to the green lamp and to a section of the center track, which should be carefully insulated from the rest. This portion of track should be long enough to allow the train to come to a full stop before reaching the next part, which gets current from the center contact point of the switch. The right contact is connected to the red lamp, while the return from both lamps and the track goes to one terminal of the transformer supplying the current. The other terminal of the transformer is connected to the switch lever. The train continues around the track as long as the switch lever makes contact between the center and left contact points, which also keeps the green light on. The moment the lever is turned to the right, so that contact is made between the center and right contacts, the green lamp goes off, the red one on, and the center section of the insulated portion of track receives no current supply for the train, which slows down and stops of its own accord. Both the red and the green lights may be mounted on a small semaphore, which can be made of wood and painted any suitable color.

Small Bar Magnet Serves as Rule Marker

When taking measurements with a steel rule where there is insufficient light to enable the worker to read the smaller divisions easily, it will be found a great help to place a small bar magnet on the rule at the point where the measurement is taken. Then the rule can be taken to the light and read without difficulty. Workmen who have poor eyesight will find this kink a valuable one.—Myron L. Harmon, South Bend, Ind.



Taking Measurements with the Aid of a Small Bar Magnet Laid on a Steel Rule

How to Prevent Sandpaper from Gumming

When the atmosphere is moist, sandpaper "gums up" surprisingly fast, and as a result much of it is wasted. To avoid this trouble the following method was found successful: A cheap electric stove, and a piece of blower pipe, about 12 in. in diameter and 2½ ft. long, were obtained. The latter was slipped over the stove and three iron rods were pushed through holes punched through the sides, about 2 in. above the stove, to serve as a rest or holder for the sandpaper. A lid was placed on the upper end of the pipe to keep the heat in. The paper will not

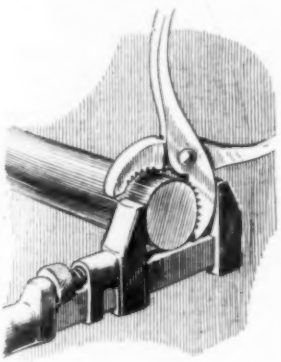
be burnt, but will be dried out in 10 to 15 minutes. Emery cloth can be treated in the same way, although the cloth gets rather stiff. This stiffness can be removed by rubbing the back over the edge of a board.—Roger C. Dickey, Salem, N. H.

Slippery Floors Made Slip-Proof

Shop floors, especially those of wood, become very slippery around a machine, owing to lubricant being spilled there from time to time and excessive foot wear. This causes the floor to take on a polish which is dangerous to the worker. To prevent it, apply a light coat of glue, and when this becomes tacky, sprinkle sand on top. When the glue has hardened, the sand will be firmly imbedded, and the danger of slipping will be minimized.

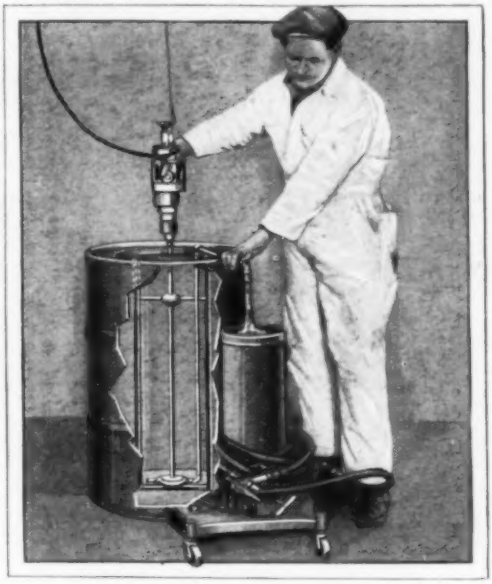
Monkey Wrench and Pliers Form Improvised Pipe Wrench

When no pipe wrench is at hand, a substitute may easily be improvised from a monkey wrench and a pair of pliers. Place one jaw of the pliers between the jaws of the wrench as shown, then tighten the wrench against the pipe in the usual way, after which the pipe can be turned in one direction. By reversing the arrangement of the two tools the pipe can be turned in the opposite direction.—W. A. Milspaw, Philadelphia.



Electric Drill Runs Homemade Pump for Filling Grease Gun

Workers at the Transcontinental-Western air express terminal at Alhambra, Calif., use an electric drill to drive a homemade pump for transferring grease from barrels to grease-gun cylinders. An old centrifugal auto water pump was attached to a barrel lid on a frame of flat iron, so that the pump could be lowered to the bottom of the grease barrel. An extension shaft attached to the pump, was passed through an improvised bearing

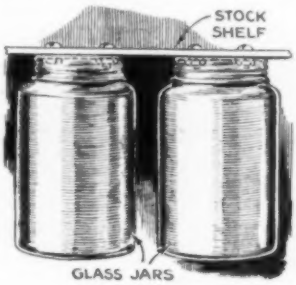


Auto Pump, Set in Grease Drum and Driven by Electric Drill, Fills Grease Gun Quickly

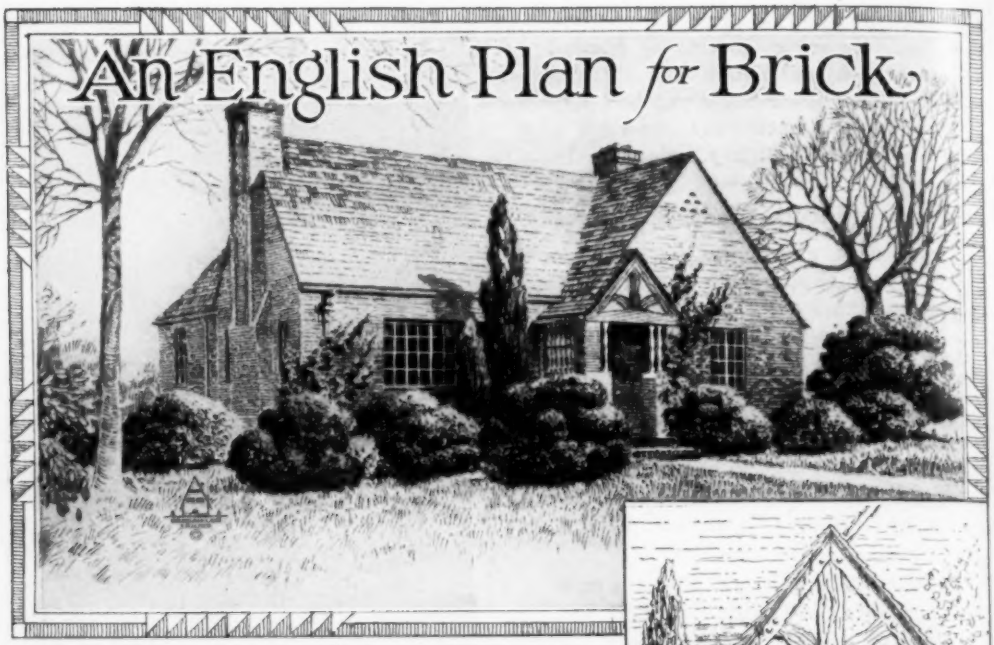
and up through the lid. Similarly a length of pipe was attached to the outlet end of the pump and projecting through the lid. Nipples and elbows were used to extend the pipe over the side of the barrel so that it could be conveniently used for filling the grease cylinder. An electric hand drill was then chucked to the upper end of the shaft.

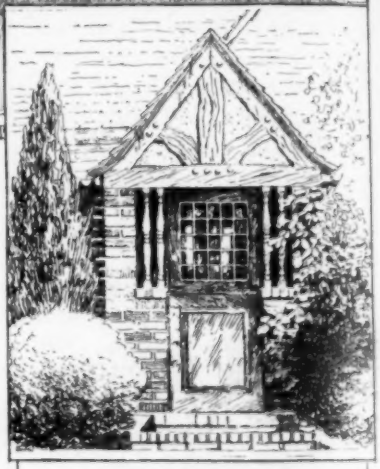
Jars Attached to Underside of Shelf Solve Storage Problem

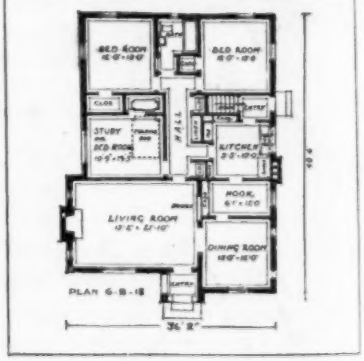
For keeping small articles on the stock-storage shelves, glass fruit jars were successfully used by an eastern merchant. The caps were screwed to the underside of the shelves, two 3/16-in. holes having been drilled in each cap. Held securely in this manner, the jars cannot tip over, and he can see if the supply of any one article is running low.



An English Plan for Brick







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A MAN writes: "All my life I have dreamed of the house I will build. It has to be a brick house." This house design suited him perfectly.

Perhaps you, too, want one of brick. If so, it does not have to be an overexpensive wall for you, because it may be very finely executed with a good grade of well-burned common brick.

This house is just about the right size for five people—may be six. It will suit a smaller family for the time being, for the den or bedroom can be made into a play room. The closet bed shown in the plan, when lifted into place, frees floor area for any use that is wanted.

The plan is a practical one both to build and to live with. Since it has a standard arrangement—long tested by home builders—it will be easy to get financing and just as easy to attract buyers. That's a decided point to be considered by everyone, though many prominent home economists say, "build your home to keep, not to sell."

The entrance detail is as English as roast beef. The rough-timber work, combined with smoothly finished balusters, makes an interesting combination of robust and delicate woodwork.

The Architects' Small House Service Bureau of the United States, Inc., was formed to furnish a complete and dependable small-house plan service at moderate cost. For information regarding the blueprints and specifications address the bureau at 1200 Second avenue, South, in Minneapolis, Minn., from which also a booklet, containing twenty-seven selected small-house plans, may be had for the price of 10 cents. The bureau is under the control of the American Institute of Architects.